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CONTENTS OF AMERICAN MUSEUM NOVITATES[1]

NUMBERS 461 TO 512

PAGE
Title-page.... i
Officers and Trustees.... iiii
Scientific Staff.... iv
Contents.... ix
List of Illustrations.... xii
List of New Taxonomic Names.... xvi
Errata.... xxiii
Index (pp. 1–26) follows Novitates No. 512.

No. 461.—'A New West Indian Polychætous Annelid.' By A. L. Treadwell. 2 pp. (One text figure.) March 10, 1931.
" 462.—'New Species of *Chrysopilus* from the Neotropical Region (Rhagionidæ, Diptera).' By C. H. Curran. 9 pp. March 17, 1931.
" 463.—'Descriptions of New Species of *Diasemopsis* Rondani (Diopsidæ, Diptera).' By C. H. Curran. 17 pp. March 21, 1931.
" 464.—'New Nearctic Collembola.' By Harlow B. Mills. 11 pp. (Twenty-seven text figures.) March 21, 1931.
" 465.—'A Young Rainbow Trout (*Salmo irideus*) with a "Horn" (The Achene of *Bidens cernua*) on Its Head.' By E. W. Gudger. 5 pp. (Three text figures.) March 21, 1931.
" 466.—'Bees Collected by the Reverend O. Piel in China.' By T. D. A. Cockerell. 16 pp. March 31, 1931.
" 467.—'New Species of Empididæ from Panama.' By C. H. Curran. 12 pp. March 31, 1931.
" 468.—'Light as a Factor in Controlling the Start of Daily Activity of a Wren and Stingless Bees.' By Frank E. Lutz. 9 pp. (One text figure.) March 31, 1931.
" 469.—'Birds Collected During The Whitney South Sea Expedition. XII.' Notes on *Halcyon chloris* and some of its subspecies.' By Ernst Mayr. 10 pp. March 31, 1931.
" 470.—'The Shovel-Tuskers, Amebelodontinæ, of Central Asia.' By H. F. Osborn and W. Granger. 12 pp. (Three text figures.) April 10, 1931.
" 471.—'The Nest Habits of the Diplopterous Wasp *Polybia occidentalis* variety *scutellaris* (White) as Observed at Barro Colorado, Canal Zone.' By Herbert F. Schwarz. 27 pp. (One text figure.) April 11, 1931.
" 472.—'Crystallographic Studies of Fluorite.' By Herbert P. Whitlock. 5 pp. (Four text figures.) May 7, 1931.
" 473.—'A Review of William Diller Matthews' Contributions to Mammalian Palæontology.' By William K. Gregory. 23 pp. May 14, 1931.
" 474.—'Diptera Collected by Dr. A. Thienemann in Java.' By C. H. Curran. 7 pp. (Five text figures.) May 20, 1931.

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[1] The Title-page, Table of Contents, and Index to this volume of Novitates (Nos. 461 to 512, inclusive) published October 3, 1931.

No. 475.—'The Disputed Structures of the Mesonacidæ and Their Significance.' By Gordon K. Bell, Jr. 23 pp. (Four text figures.) May 22, 1931.

" 476.—'New Crocodilian Remains from the Hornerstown Marls of New Jersey.' By Charles C. Mook. 15 pp. (Four text figures.) June 5, 1931

" 477.—'A New Sole from The Bahamas.' By J. R. Norman. 1 p. June 8, 1931.

" 478.—'A New *Lamprologus* from Lake Tanganyika.' By J. T. Nichols and F. R. LaMonte. 1 p. (One text figure.) June 9, 1931.

" 479.—'New Species of *Dinogamasus* (*Dolaea*), Symbiotic Mites of Carpenter Bees from the Oriental Tropics.' By Norma LeVeque. 14 pp. (Eight text figures.) July 11, 1931.

" 480.—'Bees Obtained by Professor Claude R. Kellogg in the Foochow District, China, with New Records of Philippine Bombidæ.' By T. D. A. Cockerell. 7 pp. (Two text figures.) July 14, 1931.

" 481.—'Pleistocene Mammals of Fossil Lake, Oregon.' By Herbert Oliver Elftman. 21 pp. (Ten text figures.) July 14, 1931.

" 482.—'New Species of Polychætous Annelids from California, Mexico, Porto Rico, and Jamaica.' By A. L. Treadwell. 7 pp. (Twenty-one text figures.) August 4, 1931.

" 483.—'New South American Species of Dolichopidæ.' By M. C. Van Duzee. 26 pp. (Twenty-nine text figures.) August 7, 1931.

" 484.—'New South and Central American Dolichopidæ.' By M. C. Van Duzee. 14 pp. (Thirteen text figures.) August 8, 1931.

" 485.—'Explorations, Researches and Publications of Pierre Teilhard de Chardin, 1911–1931.' By Henry Fairfield Osborn. 11 pp. August 25, 1931.

" 486.—'Birds Collected During The Whitney South Sea Expedition. XIII.' A systematic list of the birds of Rennell Island with descriptions of new species and subspecies. By Ernst Mayr. 29 pp. August 29, 1931.

" 487.—'New American Asilidæ (Diptera). II.' By C. H. Curran. 25 pp. September 5, 1931.

" 488.—'Birds Collected During The Whitney South Sea Expedition. XIV.' By Ernst Mayr. With notes on the geography of Rennell Island and the ecology of its bird life. By Hannibal Hamlin. 11 pp. (One text figure.) September 14, 1931.

" 489.—'The Parrot Finches (Genus *Erythrura*)' By Ernst Mayr. 10 pp. September 15, 1931.

" 490.—'Rocky Mountain Bees. III.' The genus *Hylæus* (*Prosopis*). By T. D. A. Cockerell and Ruth Sumner. 15 pp. (Five text figures.) September 17, 1931.

" 491.—'New or Little-known Tipulidæ in The American Museum of Natural History (Diptera). I.' By Charles P. Alexander. 16 pp. (Eighteen text figures.) September 24, 1931.

" 492.—'Twelve New Diptera.' By C. H. Curran. 13 pp. (Seven text figures.) September 25, 1931.

" 493.—'Brief Diagnoses of Twenty-six Apparently New Forms of *Marmosa* (Marsupialia) from South America.' By G. H. H. Tate. 14 pp. September 26, 1931.

" 494.—'The Distribution of Rotifera on Mount Desert Island.' By Frank J. Myers. 12 pp. September 28, 1931.

No. 495.—'A New Giant Wax Scale from Haiti.' By Herbert L. Dozier. 2 pp. (One text figure.) September 28, 1931.

" 496.—'Rocky Mountain Bees. IV.' The genus *Nomada*. By Hugo G. Rodeck. 11 pp. (One text figure.) September 29, 1931.

" 497.—'Two New Species of *Symphoromyia* (Rhagionidæ, Diptera) from the Eastern United States.' By M. D. Leonard. 2 pp. September 29, 1931.

" 498.—'Notes on the Animal Life of Thermal Waters in The Yellowstone National Park.' By Frank E. Lutz. 10 pp. October 5, 1931.

" 499.—'Some Chinese Fresh-water Fishes. XXIX.' A new goby from Hokou, Kiangsi. By J. T. Nichols. 5 pp. (Six text figures.) October 6, 1931.

" 500.—'Studies of Peruvian Birds. I.' New and other birds from Peru, Ecuador, and Brazil. By John T. Zimmer. 23 pp. October 15, 1931.

" 501.—'Phylogeny of the Heteromyid Rodents.' By Albert Elmer Wood. 19 pp. (Five text figures.) October 16, 1931.

" 502.—'Birds Collected During The Whitney South Sea Expedition. XVI.' Notes on fantails of the genus *Rhipidura*. By Ernst Mayr. 21 pp. November 9, 1931.

" 503.—'Pœciliid Fishes of the genus *Mollienisia* in Hispaniola, with Notice of a New *Limia* from the Samana Peninsula.' By George S. Myers. 2 pp. November 9, 1931.

" 504.—'Birds Collected During The Whitney South Sea Expedition. XVII.' The birds of Malaita Island (British Solomon Islands). By Ernst Mayr. 26 pp. November 11, 1931.

" 505.—'A New Insectivore from the Oligocene, Ulan Gochu Horizon, of Mongolia.' By George Gaylord Simpson. 22 pp. (Five text figures.) November 25, 1931.

" 506.—'New African Calliphoridæ (Diptera).' By C. H. Curran. 22 pp. November 27, 1931.

" 507.—'Genotype Designations of the Genera *Hydrophilus* and *Hydrochara*.' By Andrew J. Mutchler. 3 pp. November 28, 1931.

" 508.—'*Rheocloides*, a New Atherinid Fish from Madagascar.' By J. T. Nichols and F. R. LaMonte. 2 pp. (One text figure.) December 9, 1931.

" 509. 'Studies of Peruvian Birds. II.' Peruvian forms of the genera *Microbates*, *Ramphocaenus*, *Sclateria*, *Pyriglena*, *Pithys*, *Drymophila*, and *Liosceles*. By John T. Zimmer. 20 pp. December 9, 1931.

" 510. 'New and Interesting West Indian Homoptera.' By Herbert L. Dozier. 24 pp. (Eighteen text figures.) December 15, 1931.

" 511. 'Genera and New Species of Ground Sloths from the Pleistocene of Cuba.' By W. D. Matthew. With prefatory note by Walter Granger. 5 pp. December 15, 1931.

" 512.—'On the Systematic Position of the Genus *Discosorus* Hall and Related Genera.' By Curt Teichert. 11 pp. (Nine text figures.) December 29, 1931.

The edition of Novitates is 1000, of which about 100 copies are mailed on the date of issue and the others are placed on sale in the Library.

LIST OF ILLUSTRATIONS

	Novit.	Page
Cirratulus pallidus, new species: dorsal view of head	**461**	1
Proisotoma bayouensis, *Folsomia prima:* eyes, right and left side; right and left hind foot; right and left postantennal organ; right and left mucro; left view of furcula	**464**	2
Entomobrya guthriei: left hind foot; left eyes; left mucro. *Entomobrya pseudoperpulchra:* right eyes; left mucro; right hind foot; color pattern of head and thorax. *Entomobrya sabulicola:* right eyes, right mucro and right hind foot		6
Entomobrya sabulicola: dorsal view. *Drepanocyrtus reinhardi:* right eyes, left mucro, and left middle foot. *Lepidocyrtus folsomi:* left hind foot and right mucro		8
Salmo irideus: the little fish with the "horn"	**465**	2
Salmo irideus: the head and the "horn," and an achene of the "sticktight" showing details of structure		3
Graph showing recorded light in relation to the first morning song of a wren	**468**	2
Platybelodon grangeri Osborn: type mandible in oblique superior and anterior aspects	**470**	3
Platybelodon grangeri, *Amebelodon fricki*, *Phiomia osborni:* comparison of incisors		8
Platybelodon grangeri, *Amebelodon fricki*, *Trilophodon angustidens* variety *chinjiensis* and *Phiomia osborni:* comparison of incisors and jaws		9
Polybia occidentalis variety *scutellaris:* nest with its stalactite-like ornaments below	**471**	3
Fluorite crystals	**472**	2
Fluorite from Phoenixville, Pa.		3
Singular grouping of small crystals, and light green crystals crowned by light violet-red cubic crystals in parallel position		5
Herina thienemanni, *Trypanea sarangana*, *Homoneura sarangana*, and *Homoneura abana*, new species: wings of male and female, and head in profile	**474**	3
Olenellus thompsoni: molds showing rudimentary segments of the thorax to the left of the spine on the fifteenth segment, and facial sutures	**475**	3
Olenellus thompsoni: mold showing facial sutures and also the spine on the fifteenth segment of the thorax pushed to one side by the posterior rudimentary segments		4
Olenellus thompsoni, Lower Cambrian, Vermont: mold		7
Holops pneumaticus: cranial table, postorbital, frontal, and parietal bones, right and left squamosal, and maxillary bone, portions of nasal bones and isolated teeth	**476**	3
Holops pneumaticus: vertebræ		5
Holops pneumaticus: cervical ribs, dorsal ribs, sternal rib, right and left scapula, left coracoid, left humerus, right ulna, and metapodial		8
Holops pneumaticus: right and left femur, tibia, ilium, ischium, pubis, and calcaneum		13

	Novit.	Page
Lamprologus finalimus, type	**478**	1
Dinogamasus concinnus and *Dinogamasus ramaleyi*, new species	**479**	4
Dinogamasus longipes and *Dinogamasus trihirtus*, new species		6
Dinogamasus macgregori, and *Dinogamasus octonus*, new species		10
Dinogamasus bakeri and *Dinogamasus brevipes*, new species		13
Anthophora dulcifera Cockerell, Foochow district, China, and *Anthophora zonata* (Linnæus), Takao, Formosa	**480**	6
Canis dirus: right lower M_1	**481**	6
Arctotherium species: right cuneiform		8
Taxidea and *Castor*, probably new species: right maxilla and left femur		9
Camelops hesternus: parts of left maxilla and right mandible		14
Tanupolama species: left maxilla		15
Eschatius species: left maxilla and left mandible		17
Eschatius species: right mandible		18
Lumbrinereis singularisetis, *Oenone brevimaxilla*, and *Hipponoe elongata:* heads, seta, maxillæ, parapodium and gill	**482**	2
Nainereis mutilata and *Goniada teres:* heads, parapodium, neuropodial seta, slender seta, posterior parapodium, and prostomium		5
Condylostylus bisinuatus, *Condylostylus latimanus*, *Condylostylus difusus* Wiedemann, *Condylostylus ornaticauda*, *Condylostylus setitarsis*, *Condylostylus tenuitarsis*, and *Condylostylus trimaculatus*, new species: fore tarsi, hypopygia and mid-tarsi of males	**483**	6
Condylostylus trimaculatus, *Condylostylus setitarsis*, *Condylostylus rubrocauda*, *Condylostylus crassitarsis*, *Condylostylus brevipedis*, *Diaphorus willistoni*, *Chrysotus caudatus*, *Chrysotus tumidus*, *Syntormon rotundicornis*, *Neurigona grossicauda*, and *Paraclius plumicornis*, new species: wings, basitarsi, antennæ, tarsi, and hypopygia of males		17
Condylostylus sexsetosus, *Condylostylus tenuimanus*, *Diaphorus abruptus*, *Paraclius albopilosus*, *Paraclius breviventris*, *Paraclius fuscipennis*, *Paraclius nigroterminalis*, *Paraclius viridus*, *Pelastoneurus braziliensis*, *Pelastoneurus plumicauda*, and *Pelastoneurus ochreifacies*, new species: hypopygia, antennæ, and hypopygial lamellæ of males	**484**	5
Map showing relative position of Rennell Island	**488**	8
Hylæus divergens: face-marks and abdominal structures	**490**	9
Hylæus laciniatus: face-marks and abdominal structures		10
Hylæus perparvus: face-marks and abdominal structures		11
Hylæus seclusus: face-marks and abdominal structures		13
Hylæus repolitus: face-marks		14
Ozodicera (*Ozodicera*) *duidensis*, *Limonia* (*Limonia*) *roraimæ*, *Limonia* (*Dicranomyia*) *dolerosa*, *Limonia* (*Geranomyia*) *tatei*, *Limonia* (*Geranomia*) *arecuna*, *Limonia* (*Geranomyia*) *rubiginosa*, *Limnophila roraima*, *Limnophila roraimicola*, *Atarba* (*Atarba*) *unilateralis*, and *Teucholabis* (*Teucholabis*) *duidensis*, new species: wings	**491**	6
Ozodicera (*Ozodicera*) *duidensis*, *Tipula arecuna*, *Tipula duidæ*, *Limonia* (*Geranomyia*) *tatei*, *Limonia* (*Geranomyia*) *arecuna*, and *Atarba* (*Atarba*) *unilateralis*, new species: male hypopygium, lateral and dorsal aspects		7

	NOVIT.	PAGE
Rhaphium browni, *Rhaphium furcifer*, *Rhaphium septentrionale*, *Cordilura masconina*, and *Ephydra salina*, new species: head, antenna, genital lamella, and genitalia of male	**492**	3
Ficus rubricosta: branches infested with *Ceroplastes giganteus*	**495**	1
Nomada leucozoma: color pattern of first three abdominal tergites	**496**	5
Siniperca elongata, *Siniperca obscura*, and *Sarcocheilichthys* (*Barbodon*) *parvus:* types	**499**	4
Sarcocheilichthys kiangsiensis, *Leiocassis tenuifurcatus*, and *Botia compressicauda;* types		5
Mookomys parvus, *Heliscomys vetus*, *Mookomys altifluminis*, and *Perognathus fallax:* M_2, M_3, and P_4	**501**	4
Anagale gobiensis: superior, lateral, and palatal views of skull	**505**	4
Anagale gobiensis: internal, superior, and external views of right ramus of the lower jaw		7
Anagale gobiensis: outline of skull and jaw with teeth in occlusion		8
Anagale gobiensis: posterior view of skull, anterior and posterior view of atlas		12
Anagale gobiensis: dorsal view of right pes, anterior view of left tibia and fibula, outer and dorsal view of phalanges of right ramus, posterior and anterior view of left astragalus, inner and outer view of left cuboid		15
Rheocloides pellegrini, new species: type	**508**	2
Platycotis (*Lophopelta*) *tuberculatus:* Avocado twigs, showing old egg-scars, nymphs, and adults	**510**	1
Nessorhinus vulpes: dorsal and lateral views of adult		2
Nessorhinus graciloides: dorsal and lateral views of adult		3
Cicadella dubiosa, new species: frons, and male and female genitalia		5
Cicadella (*Entogonia*) *constans:* adult female, frons, and male and female genitalia		7
Cicadella (*Entogonia*) *hispaniola*, new species: frons, and male and female genitalia		8
Graphocephala haitiensis, new species: frons, and male and female genitalia		9
Phlepsius smithi, new species: frons, female and male genitalia		11
Jassus wolcotti, new species: frons, and female genitalia		12
Catonia haitiensis, new species: dorsal view of adult female, and frons		16
Ormenis coffeacola, new species: lateral view, adult female		16
Thionia gibbicollis, new species: lateral view, adult female, and frons		17
Thionia borinquensis, new species: dorsal view, adult female, and frons		18
Colpoptera clerodendri, new species: lateral view of female, and frons		19
Colpoptera nana, new species: lateral view, and frons		20
Colpoptera maculata, new species: lateral view of adult female, and frons		21
Neocolpoptera portoricensis, new species: dorsal view of head and thorax and frons		23
Neocolpoptera monticolens, new species: lateral view of adult female, and frons		24
Endodiscosorus: species from Drummond Island	**512**	2

Novit Page

Discosorus ehlersi: from Drummond Island. Diagrammatic sketch of the organic deposits within the siphuncle of *Discosorus*. . . 4

Stokesoceras engadinense and *Discosorus conoideus:* Cockburn Island, Lake Huron, Niagaran Group. *Discosorus* species: unknown locality and horizon in Canada. *Endodiscosorus foerstei*, new genus and species: from the Niagaran of Lake Timiskaming. 7

LIST OF NEW TAXONOMIC NAMES

Higher Groups

	Novit.	Page
Anagalidæ Simpson	**505**	1
Discosoridæ Teichert	**512**	11

Genera and Subgenera

	Novit.	Page
Axelempis Curran	**467**	9
Pilica Curran	**487**	20
Regasilus Curran		24
Rhamphostruthus Mayr	**489**	10
Afroborborus Curran	**492**	9
Mookomys Wood	**501**	4
Anagale Simpson	**505**	1
Rheocloides Nichols and LaMonte	**508**	1
Neocolpoptera Dozier	**510**	22
Endodiscosorus Teichert	**512**	10

Species and Subspecies

	Novit.	Page
Cirratulus pallidus Treadwell	**461**	1
Chrysopilus panamensis Curran	**462**	2
Chrysopilus bequaerti Curran		3
Chrysopilus unicus Curran		3
Chrysopilus leonardi Curran		4
Chrysopilus guianicus Curran		5
Chrysopilus cubensis Curran		5
Chrysopilus donato Curran		6
Chrysopilus macularis Curran		6
Chrysopilus latistigma Curran		7
Chrysopilus fasciventris Curran		7
Chrysopilus fascipennis Curran		8
Chrysopilus rhagiodes Curran		8
Chrysopilus argenteofasciatus Curran		9
Chrysopilus sericeus Curran		9
Diasemopsis horni Curran	**463**	4
Diasemopsis quadrata Curran		6
Diasemopsis albifacies Curran		6
Diasemopsis interrupta Curran		7
Diasemopsis elongata Curran		8
Diasemopsis disconcerta Curran		9
Diasemopsis dejectus Curran		10
Diasemopsis munroi Curran		10
Diasemopsis amorus Curran		11
Diasemopsis thaxteri Curran		12
Diasemopsis pleuritica Curran		13
Diasemopsis nebulosa Curran		13
Diasemopsis conjuncta Curran		14
Diasemopsis hirsuta Curran		15

	Novit.	Page
Proisotoma bayouensis Mills	**464**	1
Folsomia prima Mills		3
Entomobrya guthriei Mills		4
Entomobrya pseudoperpulchra Mills		5
Entomobrya sabulicola Mills		7
Drepanocyrtus reinhardi Mills		9
Lepidocyrtus folsomi Mills		10
Osmia microdonta Cockerell	**466**	1
Osmia pieli Cockerell		2
Osmia heudei Cockerell		3
Osmia rufina Cockerell		3
Megachile lagopoda pieli Cockerell		4
Coelioxys ruficincta Cockerell		5
Melecta chinensis Cockerell		6
Anthophora nigrifrons Cockerell		7
Anthophora ferreola Cockerell		7
Nomia pieli Cockerell		9
Nomia viridicinctula Cockerell		10
Andrena crassepunctata Cockerell		10
Andrena medioralens Cockerell		11
Andrena speculella Cockerell		12
Sphecodes pieli Cockerell		13
Halictus percrassiceps Cockerell		14
Halictus viridellus Cockerell		14
Halictus macrurus Cockerell		15
Halictus speculicaudus Cockerell		16
Halictus simplicior Cockerell		16
Euhyos antiqua Curran	**467**	2
Euhyos vitripennis Curran		3
Euhyos donato Curran		3
Euhyos algens Curran		4
Euhyos agens Curran		5
Euhyos negundus Curran		5
Euhyos panamensis Curran		6
Lactistomyia nigripes Curran		7
Lactistomyia mammifera Curran		7
Empis panamensis Curran		8
Axelempis fulvithorax Curran		10
Axelempis fasciventris Curran		10
Coloboneura longicornis Curran		11
Halcyon chloris santoensis Mayr	**469**	6
Halcyon chloris torresiana Mayr		7
Halcyon chloris melanodera Mayr		8
Halcyon chloris utupuæ Mayr		8
Halcyon chloris ornata Mayr		9
Halcyon chloris brachyura Mayr		9
Halcyon chloris vicina Mayr		10

	Novit.	Page
Halcyon chloris amoena Mayr		10
Herina thienemanni Curran	**474**	2
Trypanea sarangana Curran		4
Homoneura sarangana Curran		5
Homoneura abana Curran		6
Nodogymnus nicholsi Norman	**477**	1
Lamprologus finalimus Nichols and LaMonte	**478**	1
Dinogamasus kerrianus LeVeque	**479**	1
Dinogamasus concinnus LeVeque		5
Dinogamasus similis LeVeque		5
Dinogamasus ramaleyi LeVeque		5
Dinogamasus longipes LeVeque		7
Dinogamasus trihirtus LeVeque		8
Dinogamasus macgregori LeVeque		8
Dinogamasus octoconus LeVeque		11
Dinogamasus bakeri LeVeque		12
Dinogamasus brevipes LeVeque		12
Megachile faceta rufojugata Cockerell	**480**	2
Bombus geei nigribasis Cockerell		5
Bombus rufocognitus nefandus Cockerell		6
Anthophora doveri Cockerell		7
Oenone brevimaxillata Treadwell	**482**	1
Lumbrinereis singularisetis Treadwell		1
Hipponoe elongata Treadwell		3
Nainereis mutilata Treadwell		5
Goniada teres Treadwell		6
Condylostylus denticulatus Van Duzee	**483**	1
Condylostylus brevipedis Van Duzee		2
Condylostylus crassitarsis Van Duzee		3
Condylostylus bisinuatus Van Duzee		4
Condylostylus latimanus Van Duzee		5
Condylostylus distinctus Van Duzee		8
Condylostylus ornaticauda Van Duzee		9
Condylostylus setitarsis Van Duzee		10
Condylostylus tenuitarsis Van Duzee		12
Condylostylus trimaculatus Van Duzee		13
Condylostylus rubrocauda Van Duzee		13
Diaphorus willistoni Van Duzee		14
Chrysotus caudatulus Van Duzee (see Errata)		20
Chrysotus setosus Van Duzee		20
Chrysotus parvipalpus Van Duzee		21
Chrysotus tuberculatus Van Duzee		22
Chrysotus longiventris Van Duzee		23
Syntormon rotundicornis Van Duzee		24
Neurigona grossicauda Van Duzee		24
Paraclius plumicornis Van Duzee		25
Condylostylus sexetosus Van Duzee	**484**	1

	Novit.	Page
Condylostylus tenuimanus Van Duzee		2
Diaphorus abruptus Van Duzee		3
Diaphorus dyeri Van Duzee		4
Diaphorus longinervis Van Duzee		6
Hydrophorus patagonicus Van Duzee		6
Paraclius albopilosus Van Duzee		7
Paraclius breviventris Van Duzee		8
Paraclius fuscipennis Van Duzee		9
Paraclius nigroterminalis Van Duzee		10
Paraclius viridus Van Duzee		11
Pelastoneurus braziliensis Van Duzee		11
Pelastoneurus plumicauda Van Duzee		12
Pelastoneurus ochreifacies Van Duzee		13
Colymbus ruficollis longirostris Mayr	486	2
Colymbus ruficollis leucosternos Mayr		2
Colymbus ruficollis novæhollandiæ Mayr		3
Phalacrocorax melanoleucus brevicauda Mayr		3
Dupetor flavicollis pallidior Mayr		5
Threskiornis æthiopicus pygmeus Mayr		6
Ptilinopus rhodostictus cyanopterus Mayr		10
Geoffroyus heteroclitus hyacinthinus Mayr		13
Collocalia esculenta desiderata Mayr		15
Collocalia esculenta makirensis Mayr		15
Colloculia esculenta becki Mayr		16
Coracina lineata gracilis Mayr		18
Aplonis insularis Mayr		19
Turdus poliocephalus rennellianus Mayr		21
Gerygone flavolateralis citrina Mayr		22
Gerygone flavolateralis correiæ Mayr		23
Pinarolestes hamlini Mayr		23
Myiagra vanikorensis occidentalis Mayr		24
Rhipidura rennelliana Mayr		25
Pachycephala feminina Mayr		25
Myzomela cardinalis sanfordi Mayr		27
Saropogon birdi Curran	487	2
Lestomyia strigipes Curran		3
Cophura panamensis Curran		6
Cophura stylosa Curran		7
Cophura lutzi Curran		7
Psilocurus camposi Curran		8
Psilocurus birdi Curran		9
Laphystia rufofasciata Curran		13
Laphystia texensis Curran		14
Laphystia varipes Curran		15
Laphystia ochreifrons Curran		16
Laphystia litoralis Curran		16
Laphystia rufiventris Curran		17

	Novit.	Page
Laphystia salti Curran		18
Andrenosoma camposi Curran		20
Mallophora acra Curran		21
Proctacanthus bromleyi Curran		22
Erax camposiana Curran		23
Regasilus strigaria Curran		24
Dysmachus strigitibia Curran		25
Erythrura cyanovirens efatensis Mayr	**489**	8
Hylæus laciniatus Cockerell and Sumner	**490**	9
Hylæus perparvus Cockerell and Sumner		10
Hylæus seclusus Cockerell and Sumner		12
Hylæus repolitus Cockerell and Sumner		13
Ozodicera duidensis Alexander	**491**	2
Tipula arecuna Alexander		3
Tipula duidæ Alexander		4
Limonia roraimæ Alexander		5
Limonia conica turrifera Alexander		8
Limonia dolerosa Alexander		8
Limonia tatei Alexander		9
Limonia arecuna Alexander		11
Limonia rubiginosa Alexander		11
Limnophila roraima Alexander		13
Limnophila roraimicola Alexander		13
Atarba unilateralis Alexander		14
Teucholabis duidensis Alexander		15
Syntormon vanduzeei Curran	**492**	1
Rhaphium furcifer Curran		2
Rhaphium septentrionale Curran		4
Rhaphium browni Curran		5
Ephydra salina Curran		7
Borborus aptus Curran		8
Afroborborus tumidus Curran		9
Diopsis globosa Curran		9
Phytomyza dura Curran		10
Cordilura mascomina Curran		11
Cordilura browni Curran		12
Mydæa triseta Curran		13
Marmosa cinerea paraguayana Tate	**493**	1
Marmosa demararæ areniticola Tate		2
Marmosa demararæ esmeraldæ Tate		2
Marmosa demararæ meridæ Tate		3
Marmosa mapiriensis Tate		3
Marmosa germana parda Tate		4
Marmosa murina roraimæ Tate		4
Marmosa murina duidæ Tate		5
Marmosa rubra Tate		6
Marmosa tyleriana Tate		6

	NOVIT	PAGE
Marmosa yungasensis Tate		7
Marmosa ocellata Tate		7
Marmosa incana bahiensis Tate		8
Marmosa incana paulensis Tate.		8
Marmosa caucæ albiventris Tate		9
Marmosa caucæ ucayaliensis Tate		9
Marmosa microtarsus guahybæ Tate.		10
Marmosa agilis chacoensis Tate.		10
Marmosa agilis buenavistæ Tate.		10
Marmosa agilis peruana Tate.		11
Marmosa unduaviensis Tate		11
Marmosa aceramarcæ Tate		12
Marmosa lepida grandis Tate.		12
Marmosa juninensis Tate.		13
Marmosa parvidens Tate		13
Marmosa elegans coquimbensis Tate.		14
Ceroplastes giganteus Dozier	**495**	2
Nomada leucozona Rodeck.	**496**	4
Symphoromyia algens Leonard	**497**	1
Symphoromyia currani Leonard.		2
Gobius cheni Nichols.	**499**	1
Malacoptila rufa brunnescens Zimmer.	**500**	3
Conopophaga aurita inexpectata Zimmer		8
Cercomacra nigrescens fuscicauda Zimmer.		13
Cercomacra nigrescens notata Zimmer.		14
Cercomacra nigrescens aequatorialis Zimmer.		15
Schistocichla leucostigma brunneiceps Zimmer.		19
Formicarius analis olivaceus Zimmer.		21
Mookomys altifluminis Wood.	**501**	7
Rhipidura cockerelli floridana Mayr.	**502**	4
Rhipidura cockerelli coultasi Mayr.		5
Rhipidura drownei Mayr.		11
Rhipidura drownei drownei Mayr.		11
Rhipidura drownei ocularis Mayr		12
Rhipidura nebulosa altera Mayr.		13
Rhipidura rufifrons utupuæ Mayr.		17
Rhipidura rufifrons agilis Mayr		17
Rhipidura rufifrons kuperi Mayr.		18
Rhipidura rufifrons ugiensis Mayr.		19
Rhipidura rufifrons brunnea Mayr.		19
Rhipidura malaitæ Mayr.		20
Limia nicholsi Myers.	**503**	1
Accipiter novæhollandiæ malaitæ Mayr.	**504**	4
Ptilinopus solomensis ocularis Mayr.		6
Ptilinopus solomonensis ambiguus Mayr.		7
Ptilinopus solomonensis vulcanorum Mayr.		8
Ptilinopus solomonensis bistictus Mayr.		8

	NOVIT.	PAGE
Gymnophaps solomonensis Mayr		11
Ninox jacquinoti malaitæ Mayr		14
Coracina papuensis eyerdami Mayr		16
Coracina lineata malaitæ Mayr		17
Edolisoma holopolium pygmæum Mayr		18
Edolisoma holopolium tricolor Mayr		18
Aplonis grandis macrura Mayr		21
Aplonis grandis malaitæ Mayr		22
Pachycephala sanfordi Mayr		22
Monarcha barbata malaitæ Mayr		23
Myiagra ferrocyanea malaitæ Mayr		24
Myzomela cardinalis malaitæ Mayr		25
Zosterops stresemanni Mayr		26
Anagale gobiensis Simpson	**505**	2
Strongyloneura cupreithorax Curran	**506**	1
Strongyloneura varians Curran		2
Strongyloneura congensis Curran		3
Obscuria incerta Curran		4
Pericallimyia bequaerti Curran		4
Paratricyclea muscoidea Curran		5
Paratricyclea metallica Curran		6
Tricyclea kasatana Curran		6
Tricyclea major Curran		7
Tricyclea du Curran		8
Tricyclea liberia Curran		8
Tricyclea confusa Curran		9
Tricyclea similis Curran		10
Hemigymnochæta clara Curran		11
Hemigymnochæta apicifera Curran		12
Hemigymnochæta liberia Curran		12
Hemigymnochæta mitis Curran		13
Hemigymnochæta bequaerti Curran		14
Rhinia atra Curran		15
Stomorhina chapini Curran		16
Stomorhina apta Curran		17
Stomorhina mitis Curran		18
Rhynchomya nigeria Curran		19
Rhynchomya pollinosa Curran		20
Eurhynchomya thoracica Curran		21
Rheocloides pellegrini Nichols and LaMonte	**508**	1
Ramphocaenus melanurus obscurus Zimmer	**509**	2
Pyriglena leucoptera pernambucensis Zimmer		10
Pyriglena leucoptera similis Zimmer		11
Nessorhinus graciloides Dozier	**510**	3
Cicadella dubiosa Dozier		5
Cicadella hispaniola Dozier		8
Graphocephala haitiensis Dozier		9

	Novit.	Page
Graphocephala dominicana Dozier		10
Phlepsius smithi Dozier		11
Jassus wolcotti Dozier		12
Catonia haitensis Dozier		15
Ormensis coffeacola Dozier		17
Thionia gibbicollis Dozier		17
Thionia borinquensis Dozier		18
Colpoptera clerodendri Dozier		19
Colpoptera insularis Dozier		20
Colpoptera nana Dozier		20
Colpoptera maculata Dozier		21
Neocolpoptera portoricensis Dozier		22
Neocolpoptera monticolens Dozier		24
Mesocnus browni Matthew	**511**	2
Mesocnus torrei Matthew		3
Miocnus antillensis Matthew		4
Endodiscosorus foerstei Teichert	**512**	10

ERRATA

No. **463.** Page 15, line 21 from bottom: for abdundant read abundant.
“ **464.** Page 3, line 21 from top: for sohrt read short.
“ **466.** Page 10, line 1: for No. 266 read 466.
“ **466.** Page 11, line 11 from bottom: insert period instead of comma after gray.
“ **468.** Page 3, line 20 from bottom: for 7:58 read 5:58.
“ **468.** Page 5, line 20 from top: for realtively read relatively.
“ **468.** Page 7, line 20 from top: for determing read determining.
“ **473.** Page 11, line 21 from bottom: take out parentheses before and after

“ **475.** Page 2, line 11 from bottom: for *Elliplocephala* read *Elliptocephala.*
“ **475.** Page 21, line 20 from bottom: for *Masonacis* read *Mesonacis.*
“ **483.** Page 16, line 11 from top: for *Chrysotus caudatus* read *Chrysotus caudatulus.*
“ **483.** Page 16, line 16 from top: for *Chrysotus caudatus* read *Chrysotus caudatulus.*
“ **483.** Page 16, line 8 from bottom: for *Chrysotus tumidus* read *Chrysotus tuberculatus.*
“ **483.** Page 16, line 9 from bottom: for *Chrysotus caudatus* read *Chrysotus caudatulus.*
“ **483.** Page 20, line 10 from top: for *Chrysotus caudatus* read *Chrysotus caudatulus.*
“ **483.** Page 23, line 12 from top: for *Achradocera meridonalis* read *Achradocera meridionalis.*
“ **484.** Page 4, line 3 from bottom: for *Pelastoneurus braziliensis* read *Pelastoneurus brasiliensis.*
“ **485.** Page 5, line 1 from bottom: for occasiona read occasional.
“ **485.** Insert on map, at end of paper, caption as follows: Twenty-three of the Chief Fossil Collecting Areas of China, 1885–1931, as indicated by Pierre Teilhard de Chardin, February, 1931.
“ **486.** Page 9, line 4 from bottom: insert parenthesis before ‘Vögel.

ERRATA

No. **486.** Page 25, line 10 from top: for withish read whitish.
“ **486.** Page 28, line 15 from bottom: for *Zosterops griseitincta rennelliana* read *Zosterops griseotincta rennelliana.*
“ **487.** Page 16, line 24 from bottom: for immedite read immediate.
“ **489.** Page 1, This Novitates is No. XV of ‘Birds Collected During the Whitney South Sea Expedition.’
“ **491.** Page 8, line 15 from bottom: insert the word new before subspecies.
“ **492.** Page 6, line 1 from bottom: for *syntormon* read *Syntormon.*
“ **493.** Page 1, footnote: for Ridegway read Ridgway.
“ **493.** Page 11, line 6 from top: for hiars read hairs.
“ **493.** Page 11, line 10 from top: insert period after *agilis.*
“ **493.** Page 11, line 7 from bottom: for fusous read fuscous.
“ **494.** Page 1, line 17 from bottom: delete comma after (1).
“ **494.** Page 6, line 10 from top: for *Dircanophorus* read *Dicranophorus.*
“ **494.** Page 7, line 17 from top: for *Habrothrocha* read *Habrotrocha.*
“ **494.** Page 8, line 14 from bottom: for *Macrochaetus subquadtatus* read *Macrochaetus subquadratus.*
‘ **494.** Page 9, line 10 from bottom: for *Notommata pachuyra* read *Notommata pachyura.*
“ **497.** Page 2, line 15 from bottom: for intsead read instead.
“ **500.** Page 4, line 2 from top: for indistctly read indistinctly.
“ **500.** Page 6, line 15 from bottom: insert period instead of comma after Purús.
“ **500.** Page 9, line 8 from bottom: for Eucador read Ecuador.
” **504.** Page 4, line 4 from top: for *Nycticorax caledonicus mandidularis* read *Nycticorax caledonicus mandibularis.*
“ **506.** Page 6, line 6 from top; for *Paratricylea* read *Paratricyclea.*
“ **506.** Page 7, lines 21 and 22 from top: for *Tricyclea evanida* and *evenida* read *Tricyclea evaneda.*
“ **506.** Page 18, line 21 from top: for it it read it is.
“ **509.** Page 1, line 7 from bottom: for *Rhamphocaenus* read *Ramphocaenus.*
“ **510.** Page 14, line 4 from top: for 1390 read 1930.

INDEX

NOVITATES 461 TO 512

The figures in **heavy type** refer to the Novitates number; the figures in ordinary type refer to the page of that Novitates.

Absarokius, **473,** 13.
Acalanthe, **489,** 3.
Acanalonia servillei, **510,** 13.
  viriditerminala, **510,** 13.
Accipiter albogularis, **504,** 5.
  fasciatus, **488,** 3, 6.
  fasciatus vigilax, **486,** 8; **488,** 8.
  novæhollandiæ, **504,** 4.
  novæhollandiæ malaitæ, **504,** 4.
Aceratherium, **485,** 7.
Achillea millifolium, **490,** 5.
Achlya, **465,** 1.
Achradocera, **483,** 15, 18.
  angustifacies, **483,** 23.
  femoralis, **483,** 23.
  meridionalis, **483,** 23.
Acicephala polita, **492,** 12.
Acinopterus angulatus, **510,** 4.
Actitis hypoleucos, **504,** 5.
Adapis, **485,** 2.
Adapisorex, **505,** 17.
Adineta gracilis, **494,** 4.
  vaga, **494,** 4.
Adjidaumo, **501,** 3, 19.
Afroborborus, **492,** 9.
  tumidus, **492,** 9.
Agromyzidæ, **474,** 6; **492,** 10.
Albertia intrusor, **494,** 4.
Alcedo atthis salomonensis, **504,** 15.
Alexander, Charles P. 'New or Little-Known Tipulidæ in The American Museum of Natural History (Diptera).—I,' **491,** 1–16.
Alticamelus, **473,** 6.
Amaurornis olivacea, **504,** 5.
Amblynura, **489,** 3.
  kleinschmidti, **489,** 10.
Amblyornis inornatus, **486,** 27.
Ambrysus, **498,** 6, 7, 9.
  heidemanni, **498,** 6–8.
Amebelodon, **470,** 1, 6, 8–10.
  fricki, **470,** 1, 7–10.
  grangeri, **470,** 6.
Amphicyon, **485,** 2.
Anagale, **505,** 1, 2, 7, 8, 11, 13, 14, 16–20.
  gobiensis **505,** 2, 4–21.
Anagalidæ, **505,** 1.
Anaptomorphus, **485,** 2.
  homunculus, **473,** 13.
Anas gibberifrons, **486,** 7; **488,** 5, 6.
  gibberifrons gibberifrons, **486,** 7; **488,** 8.
  gibberifrons mathewsi, **486,** 7.
  superciliosa, **488,** 5, 6.
  superciliosa pelewensis, **486,** 7; **488,** 8; **504,** 4.
Anathana, **505,** 2, 13, 14.
Anchomomys, **485,** 2.
Andrena, **490,** 2.
  assimilis, **466,** 11.
  crassepunctata, **466,** 10, 11.
  formosana, **480,** 1.
  insolita **466,** 12.
  mediocalens, **466,** 10, 11.
  mimetes, **466,** 12.
  nigriceps, **466,** 12.
  sinensis, **466,** 11.
  speculella, **466,** 10, 12.
  thoracica, **466,** 11.
Andrenosoma, **487,** 19, 20.
  calogastra, **487,** 20.
  camposi, **487,** 19, 20.
  cyaniventris, **487,** 21.
  elegans, **487,** 21.
  erax, **487,** 21.
  erythropyga, **487,** 19, 20.
  punctata, **487,** 21.
  pygophora, **487,** 20.
  pyrrhacra, **487,** 19, 20.
  rufiventris, **487,** 20.
  sarcophaga, **487,** 20.
  xanthocnema, **487,** 20.
Anisonchus, **473,** 17.
Anous stolidus pileatus, **486,** 10; **488,** 7.
Anthophora abjuncta, **466,** 7.
  acervorum pennata, **466,** 7.

  agama, **466**, 7.
  cingulifera, **480**, 7.
  doveri, **480**, 7.
  dulcifera, **480**, 6. 7.
  ferreola, **466**, 7.
  melanognatha, **466**, 7.
  nigrifrons, **466**, 7.
  nigritarsis, **480**, 7.
  pingshiangensis, **466**, 7.
  pulcherrima, **466**, 8.
  walkeri nigritarsis, **480**, 7.
  zonata, **480**, 6, 7.
Antianthe expansa, **510**, 3.
  viridissima, **510**, 2.
Antilocapra americana, **481**, 5, 13.
Antilocapridæ, **481**, 13.
Apheliscus **473**, 11.
Apis mellifica, **471**, 25.
Aplonis cantoroides cantoroides, **486**, 19–21; **488**, 8.
  feadensis, **486**, 20.
  grandis, **504**, 19.
  grandis dichroa, **504**, 19, 22.
  grandis grandis, **504**, 21, 22.
  grandis macrura, **504**, 21, 22.
  grandis malaitæ, **504**, 21, 22.
  heureka, **486**, 20, 21.
  insularis, **486**, 19–21, **488**, 4, 6, 7.
  longipennis, **486**, 20, 21.
  metallica nitida, **504**, 19.
Apoclea, **487**, 24.
Arctostylops, **473**, 20.
Arctotherium, **481**, 4, 5, 8.
  simum, **481**. 8.
Ardea sacra, **486**, 4; **504**, 4.
Ardetta macrorhyncha, **504**, 4.
Aricia cirrata, **482**, 4, 5.
Armenoceras earltonensis, **512**, 5.
  geronticus, **512**, 5.
  vetustus, **512**, 5.
Artiodactyla, **481**, 5, 13.
Ascomorpha eucadis, **494**, 4.
  hyalina, **494**, 4.
  saltans, **494**, 4.
  volvocicola, **494**, 4.
Asilidæ, **487**, 1.
Asilus, **487**, 24.
Aspelta aper, **494**, 4.
  beltista, **494**, 4.
  circinator, **494**, 4
  cyldona, **494**, 4
  labri. **494**, 4.
  macra, **494**, 4
Asplanchna, **494**, 11.
  herrickii, **494**, 4.
  priodonta, **494**, 4.
Asplanchnopus hyalinus, **494**, 4.
  multiceps, **494**, 4.
Astur approximans insularis, **486**, 8.
  fasciatus vigilax, **486**, 8.
Atarba, **491**, 1, 6, 7, 14, 15.
  cincticornis, **491**, 15.
  unilateralis, **491**, 1, 6, 7, 14, 15.
Atomosia, **487**, 8.
Atops, **475**, 16.
Auchenia vitakeriana, **481**, 2, 15.
Aviceda subcristata gurneyi, **504**, 5.
Axelempis, **467**, 9.
  fasciventris, **467**, 9, 10.
  fulvithorax, **467**, 9, 10.

Baluchitherium, **485**, 3.
Barbodon, **499**, 3, 4.
Barrandia, **475**, 5.
  thompsoni, **475**, 10.
  vermontana, **475**, 10.
Bathyopsis, **473**, 17.
Baza Gurneyi, **504**, 5.
Beauchampia crucigera, **494**, 4.
Bell, Gordon, K., Jr. 'The Disputed Structures of the Mesonacidæ and their Significance,' **475**, 1–23.
Bembex spinolæ, **490**, 1.
Berberis, **496**, 10.
Beria inflata, **506**, 1, 20.
Bidens cernua, **465**, 2, 4, 5.
  cernua radiata, **465**, 4.
Bidessus affinis, **498**, 3.
Birgea enantia, **494**, 4.
Bison, **481**, 4.
Bombus, **466**, 1; **480**, 5, 6.
  baguionensis, **480**, 6.
  discrepans, **480**, 5.
  geei, **480**, 5.
  geei nigribasis, **480**, 5, 6.
  ignitus, **480**, 5.

  irisanensis, **480**, 6.
  latissimus, **480**, 5.
  mearnsi, **480**, 6.
  melanurus, **466**, 8.
  nasutus, **466**, 8.
  rufipes, **480**, 6.
  rufocognitus, **480**, 6.
  rufocognitus nefandus, **480**, 6.
  trifasciatus, **466**, 8; **480**, 5, 6.
Borboridæ, **474**, 6; **492**, 8.
Borborus aptus, **492**, 8, 9.
  clunicrus, **492**, 8.
Bos, **485**, 7.
  primigenius, **485**, 5.
Bothriocera venosa, **510**, 14.
Botia compressicauda, **499**, 3, 5.
Brachionus, **494**, 11.
  capsulifloris, **494**, 4.
  patulus, **494**, 4.
  plicatilis, **494**, 4.
  polycanthus, **494**, 4.
Brachypremna breviventris, **491**, 1.
Buckellia, **487**, 4.
  albosetosa, **487**, 5.
  vitripennis, **487**, 5.
Bursa bursa-pastoris, **490**, 5.
Buteo cristatus, **504**, 5.
Butorides striatus macrorhynchus, **504**, 4.

Cacatua ducorpsii, **504**, 13.
Cacomantis addendus, **504**, 14.
  meeki, **486**, 14.
  pyrrhophanus, **488**, 3, 10.
  pyrrhophanus meeki, **486**, 14; **488**, 8.
  variolosus addendus, **504**, 14.
Callavia, **475**, 2, 17.
  callavei, **475**, 15.
Calœnas nicobarica, **488**, 4.
  nicobarica nicobarica, **486**, 12; **488**, 8.
Calornis cantoroides, **486**, 19, 20.
  maxima, **504**, 21.
  nitida, **504**, 19.
Camelidæ, **481**, 13.
Camelops hesternus, **481**, 5, 13–16, 19.
Camelus maximus, **481**, 15.
Canidæ, **481**, 5.
Canis dirus, **481**, 4–7.
  estor, **481**, 7.
  latrans, **481**, 7.
  lestes, **481**, 4, 7.
  milleri, **481**, 6.
  occidentalis, **481**, 4, 5, 7.
  sinensis, **485**, 6.
  vulpes, **485**, 2.
Capparis comosa, **510**, 13.
Capromeryx, **481**, 4.
Carbo melanoleucus melvillensis, **486**, 4.
Carnivora, **481**, 4, 5.
Carpophaga Brenchleyi, **504**, 10.
  frauenfeldii, **486**, 10, 11.
  halmaheira, **504**, 10.
  rufigula, **504**, 10.
Cassia emarginata, **510**, 2.
Castor, **481**, 5, 9.
  canadensis, **481**, 9.
Castoridæ, **481**, 9.
Catonia haitiensis, **510**, 15, 16.
Ceneutheria, **485**, 2.
Cephalodella apocolea, **494**, 4.
  auriculata, **494**, 4.
  collactea, **494**, 4.
  compressa, **494**, 4.
  crassipes, **494**, 4.
  cuneata, **494**, 4.
  elegans, **494**, 4.
  elongata, **494**, 4.
  eva, **494**, 4.
  exigua, **494**, 4.
  forficata, **494**, 4.
  forficula, **494**, 4.
  galbina, **494**, 4.
  gibba, **494**, 5.
  gracilis, **494**, 5.
  hiulka, **494**, 5.
  hoodii, **494**, 5.
  hyalina, **494**, 5.
  innesi, **494**, 5.
  inquillina, **494**, 5.
  intuta, **494**, 5.
  magolocephalia, **494**, 5.
  mucronata, **494**, 5.
  nana, **494**, 5.
  nelitis, **494**, 5.
  physalis, **494**, 5.
  plicata, **494**, 5.

  sterea, **494,** 5.
  stirgosa, **494,** 5.
  strepta, **494,** 5.
  tantilla, **494,** 5.
  tenuior, **494,** 5.
  ventripes, **494,** 5.
Cephalogale, **485,** 2.
Cercomacra hypomelaena, **500,** 11, 12.
  nigrescens aequatorialis, **500,** 14–16.
  nigrescens approximans, **500,** 12–14.
  nigrescens fuscicauda, **500,** 13–16.
  nigrescens nigrescens, **500,** 13, 14.
  nigrescens notata, **500,** 14–16.
  serva hypomelaena, **500,** 11–13.
  serva serva, **500,** 12.
Cerdontha, **474,** 6.
Ceroplastes, **495,** 1.
  depressus, **495,** 2.
  gigas, **495,** 2.
  giganteus, **495,** 1, 2.
  vuilleti, **495,** 2.
Cervus elaphus, **485,** 5.
Cestrum inclusum, **510,** 2.
Ceyx lepida nigromaxilla. **504,** 15.
Chalcites lucidus, **488,** 3, 7.
  lucidus lucidus, **486,** 14.
  lucidus plagosus, **486,** 14.
Chalcophaps Mortoni, **504,** 12.
  stephani mortoni, **504,** 12.
Chalcosmia, **466,** 1, 2.
Chalicotherium, **485,** 4.
Charadrius fulvus, **504,** 5.
Charmosyna margarethæ, **504,** 13.
Charmosynopsis palmarum meeki, **504,** 13.
Cheirurus, **475,** 17.
Chironomidæ, **474,** 1.
Chironomus tentans, **498,** 5.
Chloralictus, **466,** 14, 15.
Chloromunia, **489,** 3.
Chlororhinia, **506,** 15, 16.
  viridis, **506,** 16.
Chlorura borneensis, **489,** 2.
  brunneiventris, **489,** 2.
  hyperythra, **489,** 1, 2.
  hyperythra malayana, **489,** 2.
  hyperythra microrhyncha, **489,** 2.
  hyperythra obscura, **489,** 2.
  intermedia, **489,** 2.
Chromogaster ovalis, **494,** 5.
Chrysopila, **462,** 1.
Chrysopilus, **462,** 1.
  argenteofasciatus, **462,** 2, 9.
  bequaerti, **462,** 2, 3.
  cubensis, **462,** 2, 5, 6.
  donato, **462,** 2, 6.
  elegans, **462,** 2, 6.
  fascipennis, **462,** 2, 8.
  fasciventris, **462,** 2, 7.
  guianicus, **462,** 2, 5.
  latistigma, **462,** 2, 7.
  leonardi, **462,** 2, 4.
  macularis, **462,** 2, 6.
  panamensis, **462,** 1–3.
  rhagiodes, **462,** 2, 8, 9.
  sericeus, **462,** 2, 9.
  stigmatias, **462,** 2.
  unicus, **462,** 2–4.
  vertebratus, **462,** 2.
Chrysosoma, **483,** 14.
Chrysotus, **483,** 15.
  angustifacies, **483,** 19.
  arcuatus, **483,** 19, 23.
  calcaratus, **483,** 18.
  caudatus, **483,** 16, 20 (see Errata).
  caudatulus, **483,** 16, 20 (see Errata).
  chilensis, **483,** 19, 23.
  contractus, **483,** 19, 23.
  edwardsi, **483,** 19, 23.
  excavatus, **483,** 19, 23.
  exceptus, **483,** 18.
  femoralis, **483,** 19.
  flavipalpis, **483,** 18.
  imitator, **483,** 18.
  laciniatus, **483,** 18.
  laminatus, **483,** 18.
  longiventris **483,** 16, 23.
  meridionalis, **483,** 19.
  metatarsatus, **483,** 19.
  obliquus, **483,** 19.
  palparis, **483,** 18.
  paradoxus, **483,** 18.
  parvipalpus, **483,** 18, 21.
  picticornis, **483,** 16.
  pictipes, **483,** 16.
  setosus, **483,** 16, 20, 22.

shannoni, **483**, 20, 23.
setosus, **483**, 22.
soleatus, **483**, 19.
subapicalis, **483**, 18.
tuberculatus, **483**, 16, 19, 20, 22, 23 (see Errata).
tumidipes, **483**, 18.
tumidus, **483**, 16 (see Errata).
unicolor, **483**, 18.
viridis, **483**, 18.
Cicadella constans, **510**, 6–9.
coffeacola, **510**, 6.
coffeaphila, **510**, 6.
dubiosa, **510**, 5.
hispaniola, **510**, 6, 8.
interrupta, **510**, 5.
occatoria, **510**, 6.
Cicadellidæ, **510**, 4.
Cinnyris jugularis flavigaster, **504**, 25.
Circotherium, **485**, 6.
Cirratulus pallidus, **461**, 1.
Clænodon, **473**, 4.
Clavator sabulonum, **487**, 3.
Clerodendron fragrans, **510**, 20.
fragrans pleniflora, **510**, 19.
Coccothrinax gracilis, **510**, 13.
Cockerell, T. D. A. 'Bees Collected by the Reverend O. Piel in China,' **466**, 1–16; 'Bees Obtained by Professor Claude R. Kellogg in the Foochow District, China, with New Records of Philippine Bombidæ,' **480**, 1–7.
Cockerell, T. D. A., and Sumner, Ruth. 'Rocky Mountain Bees. III,' **490**, 1–15.
Coelioxys fenestrata, **466**, 6.
rufescens turanica, **466**, 5.
ruficincta, **466**, 5.
suisharyonis, **466**, 6.
turneri, **466**, 6.
Cœnosia, **474**, 7.
Collocalia, **504**, 15.
esculenta, **486**, 15; **488**, 6.
esculenta becki, **486**, 16.
esculenta desiderata, **486**, 15, 16; **488**, 7.
esculenta makirensis, **486**, 15, 16.
esculenta stresemanni, **486**, 17.
esculenta tametamele, **486**, 17.
esculenta uropygialis, **486**, 15.
uropygialis heinrothi, **486**, 17.
Collotheca ambigua, **494**, 5.
atrochoides, **494**, 5.
campanulata, **494**, 5.
conklini, **494**, 5.
cornuta, **494**, 5.
edentata, **494**, 5.
heptabrachiata, **494**, 5.
hoodii, **494**, 5.
mutabilis, **494**, 5.
tenuilobata, **494**, 5.
triolobata, **494**, 5.
Coloboneura exquisita, **467**, 11.
inusitata, **467**, 11, 12.
longicornis, **467**, 11.
nubifera, **467**, 11.
Colpoptera, **510**, 22.
clerodendri, **510**, 19.
insularis, **510**, 20.
maculata, **510**, 21.
nana **510**, 20.
Columba, **504**, 11.
nicobarica, **486**, 12.
pallidiceps, **504**, 10.
superba, **504**, 6.
vitiensis halmaheira, **504**, 10.
Colurella adriatica, **494**, 5.
ambleytela, **494**, 5.
bicuspidata, **494**, 5.
obtusa, **494**, 5.
sulcata, **494**, 5.
tesselata, **494**, 5.
Colymbus ruficollis, **488**, 5, 6.
ruficollis leucosternos, **486**, 2.
ruficollis longirostris, **486**, 2; **488**, 7.
ruficollis novæhollandiæ, **486**, 2, 3.
Condylostylus, **483**, 7, 14.
bisinuatus, **483**, 4–6.
brevipedis, **483**, 2, 16.
caudatus, **484**, 3.
crassitarsis, **483**, 3, 16.
denticulatus, **483**, 1, 2.
diffusus, **483**, 6, 8, 9.
distinctus, **483**, 8.
goetghebueri, **483**, 2.

  latimanus, **483**, 5, 6.
  ornatipes, **483**, 11.
  ornaticauda, **483**, 6, 9.
  panamensis, **483**, 2.
  rubrocauda, **483**, 13, 14, 16.
  setitarsis, **483**, 6, 10, 16.
  sexsetosus, **484**, 1, 4.
  tenuimanus, **484**, 2, 4.
  tenuitarsus, **483**, 6, 12.
  terciliatus, **483**, 11.
  trimaculatus, **483**, 6, 13, 16.
  uniseriatus, **483**, 12.
  villosus, **484**, 2.
Conochiloides dossuarius, **494**, 5.
  natans, **494**, 5.
Conochilus hippocrepis, **494**, 5.
  unicornis, **494**, 5.
Conocoryphe, **475**, 16.
Conopophaga aurita aurita, **500**, 8, 9.
  aurita australis, **500**, 7–9.
  aurita inexpectata, **500**, 8, 9.
  aurita occidentalis, **500**, 8, 9.
  aurita snethlageæ, **500**, 7, 9.
Conoryctes, **473**, 11.
Cophura, **487**, 4.
  albosetosa, **487**, 4.
  bella, **487**, 4, 5.
  brevicornis, **487**, 5.
  clausa, **487**, 5.
  fur, **487**, 5.
  highlandica, **487**, 5.
  humilis, **487**, 4, 7.
  lutzi, **487**, 5, 7, 8.
  melanochaeta, **487**, 5.
  panamensis, **487**, 4–6.
  pollinosa, **487**, 5, 7, 8.
  pulchella, **487**, 5.
  scitula, **487**, 5.
  sodalis, **487**, 4–6.
  stylosa, **487**, 5, 7, 8.
  trunca, **487**, 5.
Coracina lineata, **488**, 4, 6.
  lineata gracilis, **486**, 18; **488**, 7.
  lineata malaitæ, **504**, 17.
  papuensis elegans, **504**, 16.
  papuensis eyerdami, **504**, 16.
Cordia serrata, **510**, 14.
Cordilura browni, **492**, 3, 12.
  latifrons, **492**, 11.
  masconina, **492**, 3, 11.
Coryphodon, **473**, 17; **485**, 3.
Coryphœnas crassirostris, **504**, 12.
Creotarsus, **473**, 11.
Cricetidæ, **481**, 10.
Crocisa amata, **480**, 7.
  surda, **480**, 7.
Crocodilus americanus, **476**, 4, 6, 7, 9, 11, 12, 14.
Cuculus lucidus, **486**, 14.
  optatus, **504**, 13.
  plagosus, **486**, 14.
  taitensis, **504**, 14.
Cupelopagis vorax, **494**, 5.
Curran, C. H. 'New Species of *Chrysopilus* from the Neotropical Region (Rhagionidæ, Diptera),' **462**, 1–9; 'Descriptions of New Species of *Diasemopsis* Rondani (Diopsidæ, Diptera),' **463**, 1–17; 'New Species of Empididæ from Panama,' **467**, 1–12; 'Diptera Collected by Dr. A. Thienemann in Java,' **474**, 1–7; 'New American Asilidæ (Diptera). II,' **487**, 1–25; 'Twelve New Diptera,' **492**, 1–13; 'New African Calliphoridæ (Diptera),' **506**, 1–22.
Cyaneoderes, **479**, 9, 11, 14.
Cyarda difformis, **510**, 14.
Cynodictis, **485**, 1, 2.
  gregarius, **473**, 5.
Cynodon, **485**, 1.
Cynomys, **473**, 5.
Cyphoceratops furcata, **510**, 15.
Cyphorhinus cinctus, **500**, 10.
Cypselosoma, **474**, 6.
  flavinotata, **474**, 7.
  gephyræ, **474**, 7.
Cyrtoneuropsis veniseta, **492**, 13.
Cyrtonia tuba, **494**, 5.

Dacelo grayi, **469**, 4.
Dalai Nor, **485**, 4.
Dalmanites, **475**, 17.
  eucentrus, **475**, 16.
  mucronatus, **475**, 16.

Dalmanitina, **475,** 17.
Dapidia calpidia, **494,** 5.
Dasypogon sexfasciata, **487,** 12.
Deltocephalus nigripennis, **510,** 4.
Demigretta sacra, **486,** 4; **488,** 8; **504,** 4.
Dendrogale, **505,** 2.
Deronectes striatellus, **498,** 3.
Diaphorus abruptus, **484,** 3, 4.
  aldrichi, **484,** 3.
  dyeri, **484,** 4, 6.
  funeralis, **484,** 6.
  longinervis, **484,** 4–6.
  similis, **484,** 3.
  willistoni, **483,** 14, 16.
Diasemopsis, **463,** 1–3, 17.
  æthiopica, **463,** 2–4, 10, 16, 17.
  albifacies, **463,** 3.
  amorus, **463,** 4, 11, 12.
  apicenotata, **463,** 17.
  apicifasciata, **463,** 3.
  breviseta, **463,** 3.
  concolor, **463,** 4.
  coniortodes, **463,** 3.
  conjuncta, **463,** 4, 14.
  dejectus, **463,** 4, 10.
  disconcerta, **463,** 4, 9.
  dubia, **463,** 2–4.
  elegantula, **463,** 16, 17.
  elongata, **463,** 3, 8, 9.
  fasciata, **463,** 4.
  fuscapicis, **463,** 3.
  hirsuta, **463,** 4, 15.
  horni, **463,** 3–5.
  incerta, **463,** 2–4.
  interrupta, **463,** 3, 7.
  longipedunculata, **463,** 4.
  macrophthalma, **463,** 3.
  meigenii, **463,** 3.
  munroi, **463,** 4, 10.
  nebulosa, **463,** 4, 13, 14.
  obstans, **463,** 4, 11.
  pleuritica, **463,** 4, 13.
  pulchella, **463,** 3–6.
  quadrata, **463,** 3, 6.
  robusta, **463,** 3.
  sexnotata, **463,** 3.
  signata, **463,** 3.
  silvatica, **463,** 4, 17.
  subfuscata, **463,** 4.
  terminata, **463,** 3.
  thaxteri, **463,** 4, 12.
  varians, **463,** 16, 17.
  veliventris, **463,** 16.
Dicæum æneum, **504,** 26.
  æneum æneum, **504,** 26.
Dichrozona cincta, **500,** 10, 11.
  cincta cincta, **500,** 11.
  cincta stellata, **500,** 11.
  cincta zononota, **500,** 10, 11.
Dicranomyia, **491,** 1, 6, 8, 9.
  diva, **491,** 8.
Dicranophorus alcimus, **494,** 5.
  artamus, **494,** 5.
  aspondus, **494,** 5.
  biastis, **494,** 6.
  capucinus, **494,** 6.
  colastes, **494,** 6.
  corystis, **494,** 6.
  edestes, **494,** 6.
  epicharis, **494,** 6.
  forcipatus, **494,** 6.
  grippus, **494,** 6.
  isothes, **494,** 6.
  lütkeni, **494,** 6.
  pennatus, **494,** 6.
  ponerus, **494,** 6.
  proclastes, **494,** 6.
  robustus, **494,** 6.
  semnus, **494,** 6.
  tegillus, **494,** 6.
  uncinatus, **494,** 6.
Dictyophora cubanensis, **510,** 14.
Dinogamasus, **479,** 1, 3.
  alfkeni, **479,** 3, 5, 7, 8.
  bakeri, **479,** 12–14.
  brevipes, **479,** 12, 13.
  concinnus, **479,** 3–5.
  inflatus, **479,** 9.
  jacobsoni, **479,** 9.
  kerrianus, **479,** 1, 2.
  longipes, **479,** 3, 6, 7.
  macgregori, **479,** 3, 8, 10.
  octoconus, **479,** 10–12, 14.
  perkinsi, **479,** 1.
  philippinensis, **479,** 1.
  piperi, **479,** 1.

ramaleyi, **479**, 3–5.
similis, **479**, 3, 5.
sternisetosus, **479**, 2.
trihirtus, **479**, 3, 6, 8, 9.
Diopsidæ, **463**, 2; **492**, 9.
Diopsina, **463**, 2.
Diopsis, **463**, 2.
æthiopica, **463**, 16.
dubia, **463**, 2.
globosa, **492**, 9.
Dipleuchlanis propatula, **494**, 6.
Diplolophus insolens, **501**, 5, 6.
parvus, **501**, 4–6, 11.
Dipodomys, **501**, 1, 2, 11, 12. 14–18.
Diprionomys, **501**, 1, 10, 11, 17.
parvus, **501**, 11, 18.
quartus, **501**, 11, 16, 18.
tertius, **501**, 11.
Discosoridæ, **512**, 11.
Discosorus, **512**, 1, 2, 4–6, 8–11.
conoideus, **512**, 1, 3, 6, 8.
earltonensis, **512**, 5.
ehlersi, **512**, 4, 5.
geronticus, **512**, 5.
gracilis, **512**, 9.
halli, **512**, 1.
romingeri, **512**, 9.
vetustus, **512**, 5.
Dissotrocha aculeata, **494**, 6.
macrostyla, **494**, 6.
Diurella brachyrura, **494**, 6.
cavia, **494**, 6.
collaris, **494**, 6.
insignis, **494**, 6.
porcellus, **494**, 6.
rousseleti, **494**, 6.
stylata, **494**, 6.
sulcata, **494**, 6.
tigris, **494**, 6.
weberi, **494**, 6.
Dolaea, **479**, 1, 9.
alfkeni, **479**, 3, 9.
jacobsoni, **479**, 11.
sternisetosa, **479**, 2.
Dolichopidæ, **492**, 1.
Dolichopus, **492**, 7.
Domicella, **486**, 13.
Dorymyrmex pyramicus, **471**, 22.
Dorystoma caudata, **494**, 6.
Dozier, Herbert L. 'A New Giant Wax Scale from Haiti,' **495**, 1–2; 'New and Interesting West Indian Homoptera,' **510**, 1–24.
Drapetis calva, **467**, 1.
luteicollis, **467**, 1.
tenera, **467**, 1.
Drepanocyrtus bipunctatus, **464**, 1.
reinhardi, **464**, 1, 8, 9.
Drepanura, **464**, 7.
sabulicola, **464**, 7.
Drosomyia picta, **474**, 5.
Drymophila, **509**, 1.
caudata caudata, **509**, 17, 18.
caudata hellmayri, **509**, 18.
caudata klagesi, **509**, 18.
caudata peruviana, **509**, 17.
devillei devillei, **509**, 18.
devillei subochrea, **509**, 18.
trifasciata, **509**, 9.
Ducula aurora, **486**, 11.
brenchleyi, **504**, 10.
myristicivora, **486**, 11.
oceanica, **486**, 11.
pacifica, **486**, 11; **488**, 4–6.
Ducula pacifica tarrali, **486**, 10; **488**, 8.
pistrinaria pistrinaria, **504**, 10.
rubricera rufigula, **504**, 10.
Dupetor flavicollis, **488**, 6.
flavicollis pallidior, **486**, 5; **488**, 7.
flavicollis woodfordi, **486**, 5.
Dysimia maculata, **510**, 13.
Dysithamnus subplumbeus, **500**, 18.
Dysmachus strigitibia, **487**, 25.

Eclectus pectoralis salomonensis, **504**, 13.
Ectocion, **485**, 4.
Edentata, **481**, 5, 12.
Edolisoma erythropygium, **504**, 18.
holopolium, **504**, 17.
holopolium holopolium, **504**, 17, 18.
holopolium pygmæum, **504**, 18.
holopolium tricolor, **504**, 18.
tenuirostre erythropygium, **504**, 18, 19.
tenuirostre saturatins, **504**, 18.
Elephantidæ, **481**, 12.

INDEX

Elephas columbi, **481**, 5, 12.
    imperator, **481**, 12.
    namadicus, **485**, 4–6.
    primigenius, **481**, 12.
Elftman, Herbert Oliver. 'Pleistocene Mammals of Fossil Lake, Oregon,' **481**, 1–21.
Elliptocephala asaphoides, **475**, 2, 15.
Embata laticeps, **494**, 6.
    laticornis, **494**, 6.
Embernagra, **489**, 1.
Embolotherium, **505**, 2.
Empis annulipes, **467**, 9.
    panamensis, **467**, 8, 9.
Empoasca minuenda, **510**, 4.
Encentrum eristes, **494**, 6.
    felis, **494**, 6.
    lacidum, **494**, 6.
    marinum, **494**, 6.
    nesites, **494**, 6.
    otois, **494**, 6.
    ricciæ, **494**, 6.
    zetetum, **494**, 6.
Endoceras, **512**, 10
Endodiscosorus, **512**, 2, 10, 11.
    foerstei, **512**, 6, 10.
Enochrus carinatus, **498**, 3.
    hamiltoni, **498**, 3.
Entogonia, **510**, 6–8.
Entomobrya guthriei, **464**, 1, 4, 6.
    perpulchra, **464**, 7.
    pseudoperpulchra, **464**, 1, 5, 6.
    sabulicola, **464**, 1, 6–8.
Entomolestes, **505**, 17.
Eobasileus, **473**, 17.
Eos cardinalis, **488**, 11; **504**, 12.
Eothina argus, **494**, 6.
    elongata, **494**, 6.
Ephydra hians, **492**, 7.
    salina, **492**, 3, 7.
Ephydridæ, **492**, 7.
Epistrophe nectarinus, **474**, 1.
Equidæ, **481**, 13.
Equus, **473**, 18, 19; **485**, 6, 7.
    hemionus, **485**, 4.
    minor, **481**, 5, 13.
    pacificus, **481**, 5, 13.
    sanmeniensis, **485**, 6.
Erax camposiana, **487**, 23.
    obscurus, **487**, 23.
Erigeron, **490**, 6.
Erignatha belodon, **494**, 6.
    capula, **494**, 6.
    clastopis, **494**, 6.
    tryphæa, **494**, 6.
Erinaceus, **505**, 3, 5, 9, 10.
Erythrospiza regia, **489**, 8.
    serena, **489**, 10.
Erythrura, **489**, 1, 2.
    cyaneifrons, **489**, 5.
    cyanovirens, **489**, 6, 7.
    cyanovirens cyanovirens, **489**, 6.
    cyanovirens efatensis, **489**, 8, 10.
    cyanovirens pealii, **489**, 7.
    cyanovirens regia, **489**, 8.
    cyanovirens serena, **489**, 10.
    forbesi, **489**, 3.
    hyperythra, **489**, 2.
    hyperythra borneensis, **489**, 2.
    hyperythra brunneiventris, **489**, 2.
    hyperythra hyperythra, **489**, 2.
    hyperythra intermedia, **489**, 2.
    hyperythra malayana, **489**, 2.
    hyperythra microrhyncha, **489**, 2.
    hyperythra obscura, **489**, 2.
    kleinschmidti, **489**, 10.
    modesta, **489**, 4, 5.
    papuana, **489**, 4.
    pealii, **489**, 3, 7.
    prasina, **489**, 1, 3.
    prasina cœlica, **489**, 3.
    prasina prasina, **489**, 3.
    psittacea, **489**, 6.
    pucherani, **489**, 6.
    serena, **489**, 8–10.
    trichroa, **489**, 4.
    trichroa eichhorni, **489**, 5.
    trichroa goodfellowi, **489**, 5.
    trichroa macgillivrayi, **489**, 3, 5.
    trichroa modesta, **489**, 4.
    trichroa papuana, **489**, 4.
    trichroa pelewensis, **489**, 4.
    trichroa pinaiæ, **489**, 4.
    trichroa sanfordi, **489**, 4.
    trichroa sigillifera, **489**, 5.
    trichroa cyaneifrons, **489**, 5.

  trichroa trichroa, **489**, 4.
  trichroa woodfordi, **489**, 5.
  tricolor, **489**, 3, 4.
  viridis, **489**, 2.
Eschatius, **481**, 5, 16–19.
  conidens, **481**, 2, 13, 16–19.
  longirostris, **481**, 2, 17, 18.
Euarctos americanus, **481**, 8.
Euchlanis alata, **494**, 6.
  callysta, **494**, 7.
  dilatata, **494**, 7.
  meneta, **494**, 7.
  parva, **494**, 7.
  pellucida, **494**, 7.
  phryne, **494**, 7.
  triquetra, **494**, 7.
Eudinoceras, **473**, 17.
Eudynamis orientalis alberti, **504**, 14.
  scolopacea alberti, **504**, 14.
Euhyos agens, **467**, 2, 5.
  algens, **467**, 2.
  antiqua, **467**, 2, 3.
  ardopeodes, **467**, 4.
  dentipes, **467**, 3.
  donato, **467**, 2, 3.
  negundus, **467**, 2, 5, 6.
  panamensis, **467**, 2, 6.
  purpureus, **467**, 3.
  trixothrix, **467**, 5.
  verrucicrus, **467**, 1, 2.
  vitripennis, **467**, 2, 3.
Eulabeornis woodfordi, **504**, 5.
Eupatorium odoratum, **510**, 21.
Euprotogonia, **473**, 2, 15–17.
Eurhynchomyia obtusa, **506**, 21.
  thoracica, **506**, 21.
Eurystomus orientalis solomonensis, **504**, 16.
  solomonensis, **504**, 16, 17.
Eutermes ater, **471**, 22.
  tenebrosus, **471**, 22.

Felidæ, **481**, 7.
Felis atrox, **481**, 7.
  concolor, **481**, 8.
  major, **481**, 5, 7.
  minor, **481**, 5, 8.
  oregonensis californica, **481**, 7.
  pardalis, **481**, 8.
Fiber oregonus, **481**, 5, 10.
Ficus, **510**, 12.
  rubricosta, **495**, 1, 2.
Filina, **494**, 11.
  longiseta, **494**, 7.
Floscularia conifera, **494**, 7.
  janus, **494**, 7.
  melicerta, **494**, 7.
  ringens, **494**, 7.
Fluorite, **472**, 1.
Folsomia prima, **464**, 1–3.
Formicarius analis analis, **500**, 20–22.
  analis connectens, **500**, 22.
  analis olivaceus, **500**, 21, 22.
  analis zamorae, **500**, 21, 22.
Formicivora caudata, **509**, 17.
  devillei, **509**, 18.
  maura, **509**, 13.
Fringilla chlorura, **489**, 1.
  psittacea, **489**, 3, 6.
  trichroa, **489**, 3, 4.
  tricolor, **489**, 3.
Fulgoridæ, **510**, 13.
Fulica alba, **486**, 8.

Galeopithecus, **473**, 11.
Galerix, **505**, 12, 17.
Gallicolumba beccarii, **488**, 4.
  beccarii johannæ, **486**, 12.
  beccarii solomensis, **486**, 12; **488**, 8.
Gastropus minor, **494**, 6, 7.
  orbicularis, **494**, 7.
  stylifer, **494**, 7.
Gavialis fracterculus, **476**, 1.
Geoffroyus heteroclitus heteroclitus, **488**, 6; **504**, 13.
  heteroclitus hyacinthinus, **486**, 13; **488**, 7.
Geomyidæ, **481**, 10; **501**, 18.
Geospiza cyanovirens, **489**, 6, 7.
  prasina, **489**, 7.
Geranomyia, **491**, 1, 6, 7, 9–12.
Gerygone flavolateralis, **488**, 4.
  flavolateralis citrina, **486**, 22; **488**, 7.
  flavolateralis correiæ, **486**, 22, 23.
Globicera, **486**, 11.
  tarrali, **486**, 10, 11.

Gnathias, **496**, 1–4.
Gobius cheni, **499**, 1, 2.
  cliffordpopei, **499**, 1.
  davidi, **499**, 1, 2.
  giurinus, **499**, 1.
  hadropterus, **499**, 1, 2.
Goniada teres, **482**, 5, 6.
Granger, W. See Osborn, H. F. See also, Matthew, W. D.
Graphocephala dominicana, **510**, 10.
  haitiensis, **510**, 9, 10.
Graucalus holopolius, **504**, 17.
Gregory, William K. 'A Review of William Diller Matthews' Contributions to Mammalian Palæontology,' **473**, 1–23.
Greenia alfkeni, **479**, 3.
Greeniella alfkeni, **479**, 3.
Gudger, E. W. 'A Young Rainbow Trout (*Salmo irideus*) with a "Horn" (The Achene of *Bidens cernus*) on Its Head,' **465**, 1–5.
Gymnachirus fasciatus, **477**, 1.
  melas, **477**, 1.
  nudus, **477**, 1.
Gymnometopa, **492**, 8.
Gymnophaps, **504**, 10, 12.
  albertisii, **504**, 10.
  solomonensis, **504**, 11.
Gymnopternus, **483**, 26; **492**, 7.
Gymnoptychus, **501**, 3, 18, 19.
Gymnura, **505**, 5, 7–11.

Habropoda tainanicola, **480**, 7.
Habrotrocha angusticollis, **494**, 7.
  collaris, **494**, 7.
  constricta, **494**, 7.
  eremita, **494**, 7.
  lata, **494**, 7.
  munda, **494**, 7.
Hæmatoxylon campechianum, **510**, 2.
Halcyon admiralitatis, **469**, 2, 3.
  albicilla, **469**, 2, 3.
  albicilla saurophaga, **469**, 2.
  chloris, **469**, 1–4, 8, 10; **486**, 15; **488**, 4.
  chloris abyssinica, **469**, 1.
  chloris alberti, **504**, 15.
  chloris amoena, **469**, 10; **486**, 18; **488**, 7.
  chloris brachyura, **469**, 9, 10.
  chloris grayi, **469**, 4.
  chloris hyperpontia, **469**, 6.
  chloris juliæ, **469**, 4.
  chloris melanodera, **469**, 8, 9.
  chloris ornata, **469**, 9, 10.
  chloris santoensis, **469**, 6–10.
  chloris tannensis, **469**, 4.
  chloris torresiana, **469**, 7, 9.
  chloris utupuæ, **469**, 8, 9.
  chloris vicina, **469**, 10.
  godeffroyi, **469**, 2, 3.
  juliæ, **469**, 1, 2, 4, 6, 7.
  matthiæ, **469**, 2, 3.
  nusæ, **469**, 2.
  owstoni, **469**, 2, 3.
  peali, **469**, 2, 3.
  sacra, **469**, 2.
  sancta, **469**, 1, 3, 6; **486**, 18; **488**, 7.
  saurophaga, **469**, 2, 3; **504**, 16.
  sordida, **469**, 6.
  tannensis, **469**, 4.
  tristrami alberti, **504**, 15, 16.
Haliæëtus, **504**, 5.
Haliastur indus girrenera, **504**, 5.
Halictus, **490**, 1, 2.
  aureolus, **466**, 15.
  kessleri, **466**, 15.
  laticeps, **466**, 16.
  macrurus, **466**, 13, 15.
  minutulus, **466**, 16.
  opacus, **466**, 15.
  percrassiceps, **466**, 13, 14.
  perplexans, **466**, 16.
  simplicior, **466**, 14, 16.
  speculicaudus, **466**, 14, 16.
  trichorhinus, **466**, 15.
  viridellus, **466**, 13, 14.
Hamlin, Hannibal. See Mayr, Ernst.
Hapalops, **473**, 14.
Harringia rousseleti, **494**, 7.
Heliscomys **501**, 1–6, 8, 17, 19.
  parvus, **501**, 5.
  vetus, **501**, 2, 4–7, 9, 18.
Helius, **491**, 1, 12.
  albitarsis, **491**, 1, 12.

- Helmis divergens, **498**, 3, 6, 8.
  - similis, **498**, 5–7.
- Hemigymnochæta angola, **506**, 12.
  - apicifera, **506**, 12.
  - bequaerti, **506**, 14.
  - clara, **506**, 11.
  - difficilis, **506**, 11.
  - liberia, **506**, 12.
  - mitis, **506**, 13, 14.
  - verticella, **506**, 14.
- Heminomada, **496**, 8–11.
- Hemiprocne mystacea, **488**, 6.
  - mystacea woodfordiana, **486**, 17; **488**, 8; **504**, 15.
- Heriades sauteri, **466**, 5.
- Herina thienemanni, **474**, 2, 3.
- Herpsilochmus argentatus, **509**, 4.
- Heterandria versicolor, **503**, 1.
  - zonata, **503**, 1.
- Heterohyus, **485**, 4.
- Heteromyidæ, **501**, 2, 18.
- Heteromys, **501**, 1, 2, 9, 10, 13–15, 17–19.
  - nelsoni, **501**, 10.
- Hipparion, **485**, 3, 4, 6, 7, 10.
  - sinense, **485**, 6.
- Hippidium, **473**, 18.
- Hipponoe elongata, **482**, 3, 4.
  - gaudichaudi, **482**, 4.
- Hirundo tahitica subfusca, **504**, 16.
- Holmia, **475**, 2, 15, 17.
- Holomeniscus, **481**, 15.
- Holonomada, **496**, 7, 8.
- Holops brevispinis, **476**, 2.
  - obscurus, **476**, 6.
  - pneumaticus, **476**, 2, 3, 5, 8, 13, 14.
- Homoneura abana, **474**, 3, 6.
  - coffeata, **474**, 6.
  - sarangana, **474**, 3, 5.
- Hyæna crocuta, **485**, 5.
  - machairodus, **485**, 6.
  - sinensis, **485**, 6.
- Hyalella knickerbockeri, **498**, 5–7.
- Hydrochara, **507**, 1. 3.
  - castus, **507**, 3.
  - lineatus, **507**, 3.
  - obtusatus, **507**, 3.
  - richseckeri, **507**, 3.
- Hydrocorax melanoleucus, **486**, 4.
- Hydrophilus, **507**, 1–3.
  - ater, **507**, 3.
  - caraboides, **507**, 1, 2.
  - fulvus, **507**, 2.
  - fuscipes, **507**, 2.
  - insularis, **507**, 3.
  - piceus, **507**, 1–3.
  - triangularis, **507**, 3.
- Hydrophorus diminuatus, **484**, 7.
  - patagonicus, **484**, 6, 7.
- Hydrophyllum fendleri, **490**, 5.
- Hydrous, **507**, 1, 3.
- Hylæus, **490**, 1, 2, 14.
  - annulatus, **490**, 1.
  - atrocallosus, **490**, 2.
  - basalis, **490**, 5, 14.
  - brevicornis, **490**, 1.
  - brevicornis imparilis, **490**, 1.
  - citrinifrons, **490**, 6.
  - coloradensis, **490**, 6, 14, 15.
  - conspicuus, **490**, 9, 10, 14.
  - cookii, **490**, 12.
  - cressoni, **490**, 5, 14.
  - divergens, **490**, 6–8, 15.
  - dunningi, **490**, 7.
  - elliptica, **490**, 4.
  - ellipticus, **490**, 4, 14.
  - ellipticus varifrons, **490**, 4, 15.
  - episcopalis, **490**, 7, 15.
  - gaigei, **490**, 6, 14.
  - giffardiellus, **490**, 2.
  - grossicornis, **490**, 10.
  - kahri, **490**, 1.
  - laciniatus, **490**, 9, 10.
  - magniclavis, **490**, 5.
  - marginatus, **490**, 1.
  - mesillæ, **490**, 5, 14.
  - modestus, **490**, 6, 15.
  - modestus minyra, **490**, 7.
  - perparvus, **490**, 10, 11.
  - personatellus, **490**, 15.
  - polifolii, **490**, 12, 13.
  - prænotatus, **490**, 1.
  - repolitus, **490**, 13, 14.
  - rudbeckiæ, **490**, 6, 7, 15.
  - ruidosensis, **490**, 7.
  - seclusus, **490**, 10, 12, 13.

sonorensis, **490**, 2.
stevensi, **490**, 7.
tertonis, **490**, 6.
tridens, **490**, 3.
tridentula, **490**, 3.
tridentulus, **490**, 3, 13.
tuertonis, **490**, 6.
varifrons, **490**, 3, 4.
verticalis, **490**, 3, 4, 15.
verticalis tridentulus, **490**, 4.
wootoni, **490**, 6–8, 13, 15.
Hyopsodus, **473**, 9, 16; **485**, 3.
Hypocharmosyna meeki, **504**, 12.
Hypocnemis schistacea, **500**, 16, 17.
Hyracotherium, **473**, 15; **485**, 3.
Hyrax, **485**, 3.

Ibis strictipennis, **488**, 2.
Idiella, **506**, 15, 18.
Isotoma cinerea, **464**, 4.
Itura aurita, **494**, 7.

Jassus wolcotti, **510**, 12.

Keratella paludosa, **494**, 7.
quadrata, **494**, 7.
serrulata, **494**, 7.
Koptorthosoma, **479**, 1.
æstuans, **479**, 3.

Lacinularia, **494**, 11.
Laccobius agilis, **498**, 3.
Lactistomyia hyalina, **467**, 6.
insolita, **467**, 6.
mammifera, **467**, 7.
nigripes, **467**, 7.
piceus, **467**, 6.
sequens, **467**, 7.
serrata, **467**, 7.
Ladella pallida, **510**, 14.
Lagomorpha, **481**, 5, 11.
Lagomys, **485**, 5.
LaMonte, F. R. See Nichols, J. T.
Lamprocorax grandis, **504**, 21.
Lamprologus, **478**, 1.
calliurus, **478**, 2.
finalimus, **478**, 1.
mondabu, **478**, 2.
reticulatus, **478**, 2.
Lamprotornis fulvipennis, **504**, 21.
Lanius domicella, **509**, 9.
Laphria clausicella, **487**, 21.
erythrogaster, **487**, 20, 21.
formidolosa, **487**, 20.
olbus, **487**, 21.
pyrrhopyga, **487**, 21.
rufipennis, **487**, 20.
Laphystia, **487**, 8, 10, 18.
canadensis, **487**, 11, 16, 17.
confusa, **487**, 11.
limatula, **487**, 12, 13, 17.
litoralis, **487**, 11, 16, 17.
notata, **487**, 11, 13.
ochreifrons, **487**, 11, 16.
opaca, **487**, 12, 14, 15.
rufiventris, **487**, 11, 17.
rufofasciata, **487**, 12, 13.
salti, **487**, 11, 18.
scalaris, **487**, 11, 18.
sexfasciata, **487**, 11, 12, 15.
texensis, **487**, 12, 14.
varipes, **487**, 11, 15, 16.
Lecane acronycha, **494**, 7.
agilis, **494**, 7.
aquila, **494**, 7.
arcula, **494**, 7.
brachydactyla, **494**, 7.
clara, **494**, 7.
crepida, **494**, 7.
depressa, **494**, 7.
flexilis, **494**, 7.
grandis, **494**, 7.
haliclysta, **494**, 7.
intrasinuata, **494**, 7.
jessupi. **494**, 7.
lauterborni, **494**, 7.
leontina, **494**, 7.
ligona, **494**, 7.
ludwigii, **494**, 7.
luna, **494**, 7.
mira, **494**, 7.
nana, **494**, 7.
noithis, **494**, 7.
ohioensis, **494**, 7.
pelatis, **494**, 8.
pertica, **494**, 8.

  ploenensis, **494**, 8.
  pycina, **494**, 8.
  pyrrha, **494**, 8.
  rhacois, **494**, 8.
  rhytida, **494**, 8.
  saginata, **494**, 8.
  sagula, **494**, 8.
  satyrus, **494**, 8.
  signifera, **494**, 8.
  stichæa, **494**, 8.
  stokesii, **494**, 8.
  tabida, **494**, 8.
  tenuiseta **494**, 8.
  tryphema, **494**, 8.
  ungulata, **494**, 8.
Leiocassis tenuifurcatus, **499**, 3, 5.
Leipsanolestes, **505**, 17.
Lemur, **473**, 13.
Leonard, M. D. 'Two New Species of *Symphoromyia* (Rhagionidæ, Diptera) from the Eastern United States,' **497**, 1–2.
Lepadella acuminata, **494**, 8.
  benjaminii, **494**, 8.
  cristata, **494**, 8.
  latusinus, **494**, 8.
  ovalis, **494**, 8.
  patella, **494**, 8.
  quinquecostata, **494**, 8.
  rhomboides, **494**, 8.
  rhomboidula, **494**, 8.
  triptera, **494**, 8.
Lepidocyrtus folsomi, **464**, 1, 8, 10.
  violentus, **464**, 11.
Leporidæ, **481**, 11.
Leptipalpus, **462**, 1.
Leptoplastus salteri, **475**, 12.
Lepus, **481**, 5, 11.
  californicus, **481**, 12.
  campestris, **481**, 12.
  townsendi, **481**, 12.
Lestomyia, **487**, 3.
  fraudiger, **487**, 3.
  strigipes, **487**, 3.
Leucocirca leucophrys amboynensis, **502**, 2.
LeVeque, Norma. 'New Species of *Dinogamasus* (*Dolaea*), Symbiotic Mites of Carpenter Bees from the Oriental Tropics,' **479**, 1–14.
Limia dominicensis, **503**, 1, 2.
  heterandria, **503**, 1.
  nicholsi, **503**, 1.
  versicolor, **503**, 1.
Limnias ceratophylli, **494**, 8.
  myriophylli, **494**, 8.
Limnophila kaieturana, **491**, 1, 12, 14.
  roraima, **491**, 1, 6, 8, 13, 14.
  roraimicola, **491**, 1, 6, 13, 14.
Limonia, **491**, 1, 5, 6, 8.
  arecuna, **491**, 1, 6, 7, 11.
  conica turrifera, **491**, 1, 8.
  dampfi, **491**, 9.
  diva, **491**, 1, 8.
  dolerosa, **491**, 1, 6, 8, 9.
  myersiana, **491**, 11.
  roraimæ, **491**, 1, 5, 6.
  rubiginosa, **491**, 1, 6, 11, 12.
  sanctæ martæ, **491**, 8.
  selkirki, **491**, 9.
  tatei, **491**, 1, 6, 7, 9, 10.
  townsendi, **491**, 10.
Limoniinæ, **491**, 5.
Limulus polyphemus, **475**, 5.
Lindia annecta, **494**, 8.
  fulva, **494**, 8.
  pallida, **494**, 8.
  truncata, **494**, 8.
Liomys, **501**, 1, 2, 10, 11, 14–19.
Liosceles, **509**, 1.
  erithacus, **509**, 18, 19.
  thoracicus erithacus, **509**, 18–20.
  thoracicus thoracicus, **509**, 20.
Liothyrapis, **466**, 6.
Lipotherina flavinotata, **474**, 7.
Lobospingus sigillifer, **489**, 3, 5.
Lobospiza notabilis, **489**, 3, 6.
Lophopelta, **510**, 1, 2.
Lorius cardinalis, **504**, 12.
  chlorocercus, **486**, 13; **488**, 5, 6, 8; **504**, 12.
Loxia prasina, **489**, 2, 3, 7.
Lumbrinereis singularisetis, **481**, 1, 2.
Lutra, **481**, 9.
Lutz, Frank E. 'Light as a Factor in Controlling the Start of Daily

Activity of a Wren and Stingless Bees,' **468,** 1–9; 'Notes on the Animal Life of Thermal Waters in The Yellowstone National Park,' **498,** 1–10.
Lyroneurus, **483,** 14, 15.
  adustus, **483,** 15.
  apicalis, **483,** 15.
  chabybæus, **483,** 15.
  maculatus, **483,** 15.
  simplex, **483,** 15.
  willistoni, **483,** 14.

Machairodus, **485,** 4, 6.
Macrochaetus collinsii, **494,** 8.
  subquadratus, **494,** 8.
Macropygia arossi, **504,** 12.
  rufa, **488,** 11.
  rufa arossi, **504,** 12.
  rufocastanea, **504,** 12.
Macropsis rugicollis, **510,** 4.
Macropteryx mystacea woodfordiana, **486,** 17; **504,** 15.
Macroscelides, **505,** 17.
Macrosiagon flavipenne, **490,** 1.
Macrotrachela crucicornis. **494,** 8.
  cuthberti, **494,** 8.
  ehrenbergi, **494,** 8.
  habita, **494,** 8.
  multispinosa zickendrahti, **494,** 8.
  musculosa, **494,** 8.
  nana, **494,** 8.
  plicata, **494,** 8.
  quadracornifera, **494,** 8.
Malacoptila **500,** 3–5.
  rufa brunnescens, **500,** 3, 5–7,
  rufa rufa, **500,** 3, 5–7.
Mallophora acra, **487,** 21.
  clausicella, **487,** 21.
  guildiana, **487,** 21.
  laphroides, **487,** 21.
Manis, **473,** 14.
Mareca, **486,** 7.
Marmosa, **493,** 1.
  aceramarcæ, **493,** 12.
  agilis agilis, **493,** 10.
  agilis buenavistæ, **493,** 10.
  agilis chacoensis, **493,** 10.
  agilis peruana, **493,** 11.
  caucæ albiventris, **493,** 9.
  caucæ purui, **493,** 9.
  caucæ ucayaliensis, **493,** 9.
  cinerea cinerea, **493,** 2.
  cinerea paraguayana, **493,** 1, 2.
  demararæ areniticola, **493,** 2.
  demararæ demararæ, **493,** 2.
  demararæ esmeraldæ, **493,** 2.
  demararæ meridæ, **493,** 3.
  elegans coquimbensis, **493,** 14.
  germana parda, **493,** 4.
  incana bahiensis, **493,** 8.
  incana paulensis, **493,** 8.
  juinensis, **493,** 13.
  lepida grandis, **493,** 12.
  mapiriensis, **493,** 3.
  microtarsus guahybæ, **493,** 10.
  murina duidæ, **493,** 5.
  murina klagesi, **493,** 5.
  murina madeirensis, **493,** 5, 13.
  murina muscula, **493,** 5.
  murina roraimæ, **493,** 4, 5.
  ocellata, **493,** 7.
  parvidens, **493,** 13.
  rubra, **493,** 6.
  tyleriana, **493,** 6.
  unduaviensis, **493,** 11.
  yungasensis, **493,** 7.
Mastodon, **481,** 4.
Matthew, W. D. 'Genera and New Species of Ground Sloths from the Pleistocene of Cuba.' (Prefatory note by Walter Granger), **511,** 1–5.
Mayr, Ernst. 'Birds Collected During the Whitney South Sea Expedition.'—No. XII (Notes on *Halcyon chloris* and Some of Its Subspecies), **469,** 1–10; No. XIII (Systematic List of Birds of Rennell Island, with Descriptions of New Species and Subspecies), **486,** 1–29; No. XIV (Notes on Geography of Rennell Island and the Ecology of its Bird Life), **488,** 1–11; No. XV, 'The Parrot Finches (Genus *Erythrura*), **489,** 1–10; No. XVI (Notes on Fantails of the Genus

Rhipidura), **502**, 1–21; No. XVII (Birds of Malaita Island), **504**, 1–26.

Megachile, **466**, 3: **480**, 2.
- abluta, **480**, 4, 5.
- aspernata, **480**, 4, 5.
- bicolor, **480**, 4.
- bicolor caldwelli, **480**, 3, 4.
- bicolor kagiana, **480**, 3.
- bicolor taiwana, **480**, 3.
- caldwelli, **480**, 4.
- conjuncta, **480**, 4, 5.
- dinura, **466**, 4; **480**, 4, 5.
- doederleini, **466**, 3, 4.
- faceta, **466**, 4; **480**, 2–5.
- faceta rufojugata, **480**, 2, 4.
- fletcheri, **480**, 4.
- humilis, **466**, 4.
- kagiana, **480**, 4.
- lagopoda, **466**, 4.
- lagopoda pieli, **466**, 3, 4.
- metallescens, **480**, 3.
- montoni, **466**, 4.
- pseudomonticola, **466**, 4.
- remota, **466**, 3, 4.
- remotissima, **466**, 4.
- rixator, **480**, 4, 5.
- robbii, **480**, 3.
- sculpturalis, **466**, 4.
- subignita, **480**, 3.
- subusta, **466**, 5.
- takaoensis, **480**, 3, 4.
- tsingtauensis, **480**, 3, 5.

Megadiscosorus, **512**, 5, 11.

Megalocnus, **511**, 4, 5.

Megalonyx, **481**, 4; **511**, 2.

Megapodius, **488**, 11.
- brenchleyi, **504**, 5.
- freycinet brenchleyi, **504**, 5.

Melanopareia elegans elegans, **500**, 22, 23.
- elegans paucalensis, **500**, 23.
- maranonica, **500**, 22, 23.

Melanostoma ambiguum, **474**, 2.

Melecta chinensis, **466**, 6.
- plurinotata, **466**, 6.
- quatuordecimpunctata, **466**, 6.

Membracidæ, **510**, 2.

Meniscotherium, **473**, 2.

Mesocnus, **511**, 1, 2, 4.
- browni, **511**, 2.
- torrei, **511**, 2, 3.

Mesonacis, **475**, 1, 5, 9–11, 15, 17–21.
- argentus **475**, 12, 18, 20.
- bristolensis, **475**, 12 20.
- canadensis. **475**, 12, 18, 20.
- claytoni, **475**, 12, 18, 20.
- fremonti, **475**, 12, 18.
- gilberti, **475**, 10, 11, 20.
- insolens, **475**, 12, 20.
- robsonensis, **475**, 11, 18–20.
- vermontana, **475**, 5, 10, 11, 18, 20.

Mesotrichia, **479**, 1.
- abbottii, **479**, 11, 12.
- æstuans, **479**, 9.
- bluthgeni, **479**, 3, 5.
- bombiformis, **479**, 3, 7.
- cærulea, **479**, 9, 11, 12.
- chlorina, **479**, 3, 5.
- confusa, **479**, 3, 9.
- confusa viridissima, **479**, 7.
- coronata, **479**, 3.
- cuernosensis, **479**, 3, 5, 7.
- dormeyeri, **497**, 11, 12.
- ghilianii, **479**, 3, 9.
- kerri, **479**, 2.
- philippinensis, **479**, 3, 7.
- splendidipennis, **479**, 2.
- tenuiscapa, **479**, 2.
- trifasciata, **479**, 3, 8.
- viridissima. **479**, 3, 7.

Metacheiromys, **473**, 14.

Miacis, **485**, 1.

Microbates, **509**, 1.
- cinereiventris cinereiventris, **509**, 1.
- cinereiventris magdalenae, **509**, 1.
- cinereiventris peruvianus, **509**, 1.
- cinereiventris semitorquatus, **509**, 1.

Microcerculus, **500**, 10.

Microchœrus, **485**, 2.

Microcnus, **511**, 1, 4, 5.
- gliriformis, **511**, 4.

Microcodon clavus, **494**, 8.

Microdipodops, **501**, 1, 2, 11, 16–18.

Microgale, **505**, 2.

Micronomada, **496**, 6, 7.

Micropsitta bruijni, **504**, 12.

finschii aolæ, **504**, 13.
finschii finschii, **486**, 13; **488**, 8.
Microtus montanus, **481**, 5, 10.
Mikrocodides chlæna, **494**, 8.
Mills, Harlow B. 'New Nearctic Collembola,' **464**, 1–11.
Mino dumontii sanfordii, **504**, 19.
Miocnus, **511**, 1–3.
antillensis, **511**, 3, 4.
Mniobia symbiotica, **494**, 8.
Mollienisia, **503**, 1.
dominicensis, **503**, 2.
Monarcha, **486**, 24.
barbata, **504**, 23.
barbata malaitæ, **504**, 23.
castaneiventris, **504**, 23.
castaneiventris castaneiventris, **504**, 23.
cinerascens, **488**, 11.
infelix, **504**, 23.
menckei, **504**, 23.
trivirgatus, **504**, 23.
verticalis, **504**, 23.
Monarchalba, **504**, 23.
Monommata appendiculata, **494**, 8.
astia, **494**, 9.
caudata, **494**, 9.
cæca, **494**, 9.
diaphora, **494**, 9.
enedra, **494**, 9.
grandis, **494**, 9.
hyalina, **494**, 9.
longiseta, **494**, 9.
maculata, **494**, 9.
Monostyla acus **494**, 9.
bifurca, **494**, 9.
bulla, **494**, 9.
closterocerca, **494**, 9.
crenata, **494**, 9.
elachis, **494**, 9.
furcata, **494**, 9.
hamata, **494**, 9.
lunaris, **494**, 9.
monostyla, **494**, 9.
pygmæa, **494**, 9.
quadradentata, **494**, 9.
rhopalura, **494**, 9.
styrax, **494**, 9.
tethis, **494**, 9.
vastita, **494**, 9.
Mook, Charles C. 'New Crocodilian Remains from the Hornerstown Marls of New Jersey,' **476**, 1–15.
Mookomys, **501**, 1, 2, 4, 5, 7, 9–17.
altifluminis, **501**, 3–9, 12–14, 17–19.
parvus, **501**, 4–9, 12, 17–19.
Moschus, **485**, 5.
Muridæ, **481**, 10.
Musca domestica, **471**, 22.
Muscicapa albogularis, **502**, 9.
Muscidæ, **474**, 7; **492**, 11.
Muscipeta melaleuca, **502**, 2; **504**, 24.
Muscylva, **502**. 9.
pectoralis, **502**, 16.
Mustelidæ, **481**, 9.
Mutchler, Andrew J. 'Genotype Designations of the Genera *Hydrophilus* and *Hydrochara*,' **507**, 1–3.
Mycetophila binotata, **474**, 1.
Mycetophilidæ, **474**, 1.
Mydæa triseta, **492**, 13.
Myers, Frank J. 'The Distribution of Rotifera on Mount Desert Island. Part I,' **494**, 1–12.
Myers, George S. 'Pœciliid Fishes of the Genus *Molliensia* in Hispaniola, with Notice of a New *Limia* from the Samaná Peninsula,' **503**, 1–2.
Myiagra ferrocyanea malaitæ, **504**, 24.
vanikorensis, **488**, 6.
vanikorensis melanura, **486**, 24, 25.
vanikorensis occidentalis, **486**, 24; **488**, 7.
Myiolestes megarhynchos, **486**, 24.
Mylodon harlani, **481**, 5, 12.
sodalis, **481**, 2, 12.
Mylodontidæ, **481**, 12.
Myothera analis, **500**, 20, 21.
leuconota **509**, 10.
Myrmeciza schistacea intensa, **500**, 18, 19.
Mytilina, **494**, 11.
Mytilina ventralis, **494**, 9.
Myzomela caledonica, **486**, 28.
cardinalis, **486**, 28; **488**, 4, 10.
cardinalis malaitæ, **504**, 25.
cardinalis pulcherrima, **486**, 27.

  cardinalis sanfordi, **486**, 27, 28; **488**, 7.
  chermesina, **486**, 28.
  dibapha. **486**, 28.
  erythrocephala, **486**, 28.
  jacquinoti, **504**, 25.
  nigriventris, **486**, 28.
  pulcherrima, **486**, 28.
  rubatra, **486**, 28.

Nainereis mutilata, **482**, 5.
Nannopithex, **485**, 2.
Nasiterna aolæ, **504**, 13.
  finschii, **486**, 13.
Naucoris cimicoides, **498**, 8.
Necrolemur, **485**, 2.
Nectarinia flavigastra. **504**, 25.
Necrolestes, **473**, 22.
Neobuchia paulinæ, **495**, 2.
Neocolpoptera, **510**, 22.
  monticolens, **510**, 24.
  portoricensis, **510**, 22–24.
Neoctantes niger, **500**, 9.
Neolimnobia, **491**, 1, 8.
Neolophonotus, **487**, 24.
Nereis brevicirrata, **482**, 3.
  largoensis, **482**, 3.
Nessorhinus gibberulus, **510**, 3.
  graciloides, **510**, 3.
  vulpes, **510**, 2.
Neurigona grossicauda, **483**, 16, 24.
Nevadia, **475**, 2, 8, 15, 17.
Nichols, J. T. 'Some Chinese Fresh-Water Fishes. XXIX.—A New Goby from Hokou, Kiangsi,' **499**, 1–5.
Nichols, J. T., and La Monte, F. R. 'A New *Lamprologus* from Lake Tanganyika,' **478**, 1–2; '*Rheocloides*, a New Atherinid Fish from Madagascar,' **508**, 1–2.
Ninox, **504**, 15.
  jacquinoti malaitæ, **504**, 14.
  jacquinoti roseoaxillaris, **504**, 14, 15.
Nodogymnus fasciatus, **477**, 1.
  nicholsi, **477**, 1.
  zebrinus, **477**, 1.
Nomada, **496**, 1, 2.
  albofasciata, **496**, 5.
  carolinæ, **496**, 2, 3.
  civilis, **496**, 8–10.
  collinsiana, **496**, 9, 10.
  crawfordi, **496**, 9, 10.
  ednæ, **496**, 9, 10.
  edwardsii, **496**, 8.
  erythrochroa, **496**, 6.
  flava, **466**, 7.
  fragilis, **496**, 8. 9.
  heterosticta, **496**, 2, 3.
  koreana, **466**, 7.
  lepida, **496**, 1, 2.
  lepida cuneata, **496**, 1, 2.
  leucozona, **496**, 1, 4, 5.
  luteoloides, **496**, 9, 11.
  modesta, **496**, 6, 7.
  modocorum, **496**, 9–11.
  ornithica, **496**, 8, 10.
  orophila, **496**, 1, 4.
  putnami, **496**, 6, 7.
  ruficornis, **466**, 7.
  tintinnabulum, **496**, 10.
  vicinalis, **496**, 9, 10.
  vincta, **496**, 7, 8.
  vincta heterochroa, **496**, 8.
  zebrata, **496**, 7, 8.
Nomadula, **496**, 5, 6.
  semiscita, **496**, 6.
  scita, **496**, 5, 6.
Nomia chalybeata, **466**, 8, 9.
  curvipes, **466**, 8, 9.
  megasoma, **466**, 10.
  pavonura, **466**, 9.
  pieli, **466**, 8, 9.
  punctulata, **466**, 9.
  recessa, **466**, 10.
  rustica, **466**, 10.
  viridicinctula, **466**, 9, 10.
Norman, J. R. 'A New Sole from the Bahamas,' **477**, 1.
Notharctus, **473**, 13.
Nothodectes, **473**, 11; **485**, 2, 3.
Notholca bostoniensis, **494**, 9.
  longispina, **494**, 9.
  striata, **494**, 9.
Notommata cerberus, **494**, 9.
  codonella, **494**, 9.

contorta, **494**, 9.
copeus, **494**, 9.
cyrtopus, **494**, 9.
doneta, **494**, 9.
falcinella, **494**, 9.
lenis, **494**, 9.
pachyura, **494**, 9.
pachyura triangularis, **494**, 9.
peridia, **494**, 9.
pseudocerberus, **494**, 9.
pygmæa, **494**, 9.
telmate, **494**, 9.
thopica, **494**, 9.
tithasa, **494**, 9.
saccigera, **494**, 9.
silpha, **494**, 9.
Notostylops, **473**, 20.
Nusa, **487**, 19.
cyrtophora, **487**, 21.
phonicogaster, **487**, 20.
rubidapex, **487**, 20.
Nycticorax caledonicus mandibularis, **504**, 4.
mandibularis, **504**, 4.
Nyctitherium, **473**, 11.

Obscuria incerta, **506**, 3, 4.
spinicosta, **506**, 3.
Octotrocha speciosa, **494**, 9.
Oenone brevimaxillata. **482**, 1, 2.
Œnothera, **490**, 6.
Olenellus, **475**, 1, 5, 6, 8–12, 17, 18, 20.
fremonti, **475**, 12.
gilberti, **475**, 12.
longani, **475**, 20.
thompsoni, **475**, 2–5, 12, 20.
truemani, **475**, 20.
vermontana, **475**, 5, 10.
Olenus, **475**, 5, 16.
thompsoni, **475**, 10.
Omomys, **485**, 4.
Onychodectes, **473**, 11.
Opeatocerata rubida, **467**, 1.
Oreobatus deliciosus, **490**, 4.
Ormenis coffeacola, **510**, 16, 17.
Ortalidæ, **474**, 2.
Ortalis, **474**, 2.
Orthoceras conoideus, **512**, 2.
docens, **512**, 2.
Orycteropus, **473**, 14, 15.
Osborn, Henry Fairfield, 'Explorations, Researches and Publications of Pierre Teilhard de Chardin,' **485**, 1–11.
Osborn, H. F., and Granger, W. 'The Shovel-Tuskers, Amebelodontinæ, of Central Asia,' **470**, 1–12.
Osmia, **466**, 1.
angustula, **466**, 2.
balearica, **466**, 2.
heudei, **466**, 1, 2.
latreillei, **466**, 2.
microdonta, **466**, 1.
mitsukurii, **466**, 3.
orientalis, **466**, 2.
panzeri, **466**, 2.
ped cornis, **466**, 1.
pieli, **466**, 1, 2.
rufa, **466**, 3.
rufina, **466**, 1, 3.
subtersa, **466**, 2.
Oxyna parca, **474**, 4.
Ozodicera, **491**, 2, 3, 6, 7.
duidensis, **491**, 1–3, 6, 7.

Pachycephala, **486**, 24.
feminina, **486**, 25–27; **488**, 4, 7.
pectoralis, **486**, 26; **504**, 22.
sanfordi, **504**, 1, 22, 25.
Pachycynodon, **485**, 2.
Pachyosmia, **466**, 2, 3.
Pædeumias, **475**, 1, 5, 6, 8–11, 15, 17.
robsonensis, **475**, 15.
transitans, **475**, 2, 4, 5, 13.
Palaeanodon ignavus, **473**, 14.
Palæoloxodon, **485**, 4, 6.
Palæonictus, **485**, 4.
Palæoscaptor, **505**, 12, 13.
Palæoloxodon, **485**, 4.
Palæosinopa, **473**, 11.
Palpomyia, **498**, 5–7.
Pandion haliætus cristatus, **504**, 5.
Pantolambda, **473**, 17.
Pantolestes, **473**, 9, 11.
Papilio castor, **480**, 2.
gigas, **485**, 6.

Paracamelus, **485**, 6.
Paraclius, **483**, 26.
  albinus, **484**, 8.
  albopilosus, **484**, 4, 7.
  brevimanus, **484**, 10.
  breviventris, **484**, 4, 8, 9.
  edwardsi, **484**, 10.
  fuscipennis, **484**, 4, 9.
  nigroterminalis, **484**, 4, 10.
  plumicornis, **483**, 16, 24.
  ovatus, **484**, 9.
  robustus, **484**, 11.
  stylatus, **484**, 10.
  tylophanus, **484**, 9.
  viridus, **484**, 4, 11.
Paracymus subcupreus, **498**, 5, 6.
Paradoxides, **475**, 21.
Parahydriena hyalina, **510**, 14.
Parelephas, **485**, 4.
Paratricyclea cœrulea, **506**, 6.
  metallica, **506**, 6.
  muscoidea, **506**, 5.
  stabulans, **506**, 6.
Paramys, **473**, 12, 13; **501**, 2.
Parasyntormon, **492**, 1.
Pelastoneurus brasiliensis, **484**, 4, 11, 14.
  digitulus, **484**, 13.
  flavipes, **484**, 12, 14.
  ochreifacies, **484**, 4, 13.
  plumicauda, **484**, 4, 12.
Pelycodus, **473**, 13.
Pericallimyia bequaerti, **506**, 4.
  spinigera, **506**, 4.
Peridiomys, **501**, 1, 9–11, 14, 15, 17, 19.
  rusticus, **501**, 9, 18.
Periptychus, **473**, 17.
Perissodactyla, **481**, 5, 13.
Perognathus, **501**, 1–4, 7, 9, 11–13, 15–19.
  fallax, **501**, 4, 8–13.
  furlongi, **501**, 13, 18.
Phacops, **475**, 17.
Phalacrocorax melanoleucus, **486**, 3, 4; **488**, 5, 6.
  melanoleucus brevicauda, **486**, 3; **488**, 7.
  melanoleucus melanoleucus, **486**, 4.
Phenacodus, **473**, 15, 16; **485**, 4.
Philodina acuticornis, **494**, 10.
  citrina, **494**, 10.
  megalotrocha, **494**, 10.
  plena, **494**, 10.
Phiomia, **470**, 6, 8, 10.
  osborni, **470**, 8, 9.
Phlaocyon, **473**, 4; **485**, 2.
Phlepsius smithi, **510**, 11.
Phlogœnas solomonensis, **486**, 12.
Phylloscopus trivirgatus becki, **504**, 24.
Phytomyza dura, **492**, 10.
  lactuca, **492**, 11.
Piezormona, **504**, 23.
Pilica, **487**, 19, 20.
  olbus, **487**, 19, 20.
Piloceras, **512**, 3.
Pinarolestes hamlini, **486**, 23; **488**, 4, 7, 9.
  macrorhynchus, **486**, 24.
  vitiensis, **486**, 24.
Piper amalago, **510**, 4.
Pithys, **509**, 1.
  albifrons albifrons, **509**, 17.
  albifrons brevibarba, **509**, 17.
  albifrons peruviana **509**, 16, 17.
Placoparia, **475**, 17.
Plagiomene, **473**, 11.
Plannaria foremanii, **498**, 7, 8.
Platalea leucorodia regia, **486**, 5; **488**, 5, 8.
  regia, **486**, 5; **488**, 6.
Platybelodon, **470**, 1, 6, 8–10.
  danovi, **470**, 1, 2, 4, 6, 11.
  grangeri, **470**, 1–6, 8, 9.
Platycotis ornata, **510**, 2.
  tuberculatus, **510**, 1, 2.
Platygonus minor, **481**, 5, 13.
  vetus, **481**, 5, 13.
Platyias quadracornis, **494**, 10.
Platynopoda, **479**, 1.
Platypœcilus dominicensis, **503**, 2.
Plesiadapis, **473**, 11; **485**, 4.
Plesictis, **485**, 2.
Plesippus, **473**, 19.
Pleuraspidotherides, **485**, 2.
Pleurotrocha petromyzon, **494**, 10.
  robusta, **494**, 10.
Pliohippus, **473**, 18, 19.
Plœsoma lenticulare, **494**, 10.
  triacanthum, **494**, 10.

  truncatum, **494**, 10.
Pluvialis dominicus fulvus, **504**, 5.
Podiceps fluviatilis carteræ, **486**, 3.
  fluviatilis parryi, **486**, 3.
  novæhollandiæ, **486**, 3.
Pœcilia melanogaster, **503**, 2.
Pogonosoma, **487**, 19.
Polistes annularis, **471**, 22.
  pallipes, **471**, 22.
  variatus, **471**, 22.
Polyarthra euryptera, **494**, 10.
  trigla, **494**, 10.
Polybia fastidiosuscula, **471**, 1.
  occidentalis, **471**, 5.
  occidentalis diguetana, **471**, 6.
  occidentalis scutellaris, **471**, 1, 3, 5, 6, 22–24, 26.
  parvula, **471**, 6.
  scutellaris paulista, **471**, 22.
Pomarea, **486**, 24.
Ponera punctatissima trigona, **471**, 22.
Porphyrio, **488**, 5.
  albus, **486**, 8; **488**, 4, 6, 8; **504**, 5.
  albus melanopterus, **486**, 8.
  calvus, **486**, 8.
  cyanophalus, **486**, 8.
  melanopterus, **486**, 8, 9.
Porphyrochroa, **467**, 9.
Potentilla filipes, **490**, 5.
Praolestes, **505**, 11.
Pratobombus, **480**, 6.
Proales brevipes, **494**, 10.
  decipiens, **494**, 10.
  doliaris, **494**, 10.
  neapolitana, **494**, 10.
  parasita. **494**, 10.
  reinhardti, **494**, 10.
  similis, **494**, 10.
  sordida, **494**, 10.
Proalinopsis caudatus, **494**, 10.
  staurus, **494**, 10.
Proboscidea, **481**, 5, 12.
Proctacanthus bromleyi, **487**, 22.
  tibialis, **487**, 22.
Prodinoceras, **473**, 17.
Proisotoma bayouensis, **464**, 1, 2.
Pronycticebus, **485**, 2.
Prosopis, **490**, 1–3.
  glandulosa, **490**, 1.
  nucleolus, **490**, 6.
  tridentula, **490**, 3.
  varifrons, **490**, 4.
  verticalis, **490**, 3.
Protalebra similis, **510**, 4.
Proteraner, **466**, 13.
Pseudhelicoptera, **510**, 14.
  nasuta, **510**, 14.
Pseudictops, **505**, 11.
Pseudoecistes rotifer, **494**, 10.
Pseudogerygone rouxei, **486**, 23.
Pseudoloris, **485**, 2.
Psilocurus, **487**, 8.
  birdi, **487**, 8–10.
  camposi, **487**, 8.
  caudatus, **487**, 8.
  modestus, **487**, 8.
  nudiusculus, **487**, 8, 10.
Psittacus domicella, **486**, 13.
  Geoffroyus heteroclitus, **504**, 13.
Ptilinopus johannis, **504**, 9.
  porphyraceus, **486**, 10.
  rhodostictus, **486**, 10; **488**, 4, 5, 10.
  rhodostictus cyanopterus, **486**, 10; **488**, 7.
  rivolii bellus, **504**, 9.
  rivolii prasinorrhous, **504**, 9.
  solomonensis, **504**, 6–8.
  solomonensis ambiguus, **504**, 7.
  solomonensis bistictus, **504**, 8.
  solomonensis johannis, **504**, 9.
  solomonensis meyeri, **504**, 6, 9.
  solomensis neumanni, **504**, 6, 9.
  solomensis ocularis, **504**, 6, 7.
  solomensis speciosus, **504**, 9.
  solomonensis solomonensis, **504**, 6, 8.
  solomonensis vulcanorum, **504**, 8.
  superbus superbus, **504**, 6.
  viridis lewisi, **504**, 10.
Ptilocercus, **505**, 3, 5, 7–10, 13.
Ptilopus ceraseipectus, **504**, 6.
  Lewisi. **504**, 10.
  speciosus, **504**, 9.
Pyriglena, **509**, 1, 5.
  castanoptera, **509**, 15.
  leucoptera castanoptera, **509**, 7, 14–16.

  - leucoptera hellmayri, **509,** 13, 16, 17.
  - leucoptera leuconota, **509,** 9–11, 13, 16.
  - leucoptera leucoptera, **509,** 8, 13, 15, 16.
  - leucoptera marcapatensis, **509,** 9, 14, 16.
  - leucoptera maura, **509,** 13, 14, 16.
  - leucoptera pacifica, **509,** 9, 15, 16.
  - leucoptera pernambucensis, **509,** 10, 16.
  - leucoptera picea, **509,** 8, 11, 12, 14, 16.
  - leucoptera similis, **509,** 11, 12, 16.
  - pacifica, **509,** 15.
  - picea, **509,** 14.

- Ramphocaenus, **509,** 1.
  - melanurus albiventris, **509,** 3.
  - melanurus amazonúm, **509,** 1–4.
  - melanurus griseodorsalis, **509,** 4.
  - melanurus melanurus, **509,** 3.
  - melanurus obscurus, **509,** 2–4.
  - melanurus rufiventris, **509,** 4.
  - melanurus sanctae-marthae, **509,** 4.
  - melanurus sticturus, **509,** 2, 3.
  - melanurus trinitatis, **509,** 3, 4.
- Regasilus, **487,** 24.
  - strigaria, **487,** 24.
- Reichenowia, **489,** 1.
- Resticula anceps, **494,** 10.
  - melandocus, **494,** 10.
  - nyssa, **494,** 10.
- Rhamphidia albitarsis, **491,** 12.
- Rhamphostruthus, **489,** 10.
- Rhaphium browni, **492,** 3, 5, 6.
  - effilatum, **492,** 4, 5.
  - furcifer, **492,** 2, 3.
  - lugubre, **492,** 6.
  - septentrionale, **492,** 3, 4.
  - vanduzeei, **492,** 6.
- Rheocles, **508,** 1.
- Rheocloides, **508,** 1.
  - pellegrini, **508,** 1, 2.
- Rhinia, **506,** 14–16.
  - apicalis, **506,** 15.
  - atra, **506,** 15.
  - simulatrix, **506,** 15.
- Rhinoceros, **485,** 7.
  - sinensis, **485,** 6.
  - tichorhinus, **485,** 5.
- Rhinogobius, **499,** 1.
- Rhipidia, **491,** 1, 8.
- Rhipidura, **486,** 25; **502,** 1, 6.
  - albicollis, **502,** 8, 9.
  - albina, **502,** 5, 7.
  - albogularis, **502,** 9.
  - astrolabi, **502,** 16.
  - brenchleyi, **502,** 14, 15.
  - cockerelli, **502,** 1, 3–7.
  - cockerelli albina, **502,** 5.
  - cockerelli cockerelli, **502,** 4.
  - cockerelli coultasi, **502,** 5; **504,** 24.
  - cockerelli floridana, **502,** 4.
  - cockerelli interposita, **502,** 4.
  - cockerelli lavellæ, **502,** 7.
  - cockerelli septentrionalis, **502,** 3, 4.
  - dahli, **502,** 16.
  - drownei, **502,** 7, 8, 11.
  - drownei drownei, **502,** 11.
  - drownei ocularis, **502,** 12.
  - erromangæ, **502,** 14, 15.
  - erythronota, **502,** 8.
  - flabellifera, **502,** 1. 13, 16.
  - flabellifera brenchleyi, **502,** 14.
  - flabellifera harterti, **502,** 20.
  - fuscescens, **502,** 13.
  - harterti, **502,** 20.
  - kubaryi, **502,** 16.
  - layardi, **502,** 9.
  - leucophrys, **502,** 1, 2.
  - leucophrys melaleuca, **502,** 2; **504,** 24.
  - malaitæ, **502,** 1, 20; **504,** 1, 4, 24, 25.
  - matthiæ, **502,** 16.
  - melanolæma, **502,** 16.
  - nebulosa, **502,** 1, 13.
  - nebulosa altera, **502,** 13.
  - nebulosa nebulosa, **502,** 13.
  - personata, **502,** 1, 15.
  - rennelliana, **486,** 25; **488,** 4, 7; **502,** 7, 8.
  - rubrofrontata, **502,** 19.
  - rufifrons, **502,** 1, 2, 16, 18.
  - rufifrons agilis, **502,** 17.
  - rufifrons brunnea, **502,** 19, 24.
  - rufifrons commoda, **502,** 20.

  rufifrons granti, **502,** 20.
  rufifrons kubaryi, **502,** 17.
  rufifrons kuperi, **502,** 18.
  rufifrons melanolæma, **502,** 16, 17.
  rufifrons rufofronta, **502,** 19, 20.
  rufifrons russata, **502,** 18.
  rufifrons ugiensis, **502,** 19.
  rufifrons utupuæ, **502,** 17.
  rufilateralis, **502,** 8.
  russata, **502,** 18.
  sancta, **502,** 9, 10.
  spilodera, **502,** 1, 2, 7–11.
  spilodera erythronota, **502,** 8.
  spilodera layardi, **502,** 9.
  spilodera rufilateralis, **502,** 8.
  spilodera spilodera, **502,** 8, 9.
  spilodera verreauxi, **502,** 10.
  tenebrosa, **502,** 8, 12.
  verreauxi, **502,** 10.
Rhissidura rufofronta, **502,** 19.
Rhynchocyon, **505,** 9, 14, 17.
Rhynchomya crinicauda, **506,** 19.
  discrepans, **506,** 22.
  nigeria, **506,** 19.
  pollinosa, **506,** 20.
  tetropsis, **506,** 20, 22.
Rhyticeros plicatus mendanæ, **504,** 16.
Rodeck, Hugo G. 'Rocky Mountain Bees. IV,' **496,** 1–11.
Rodentia, **481,** 5, 9; **501,** 2.
Rotaria elongata, **494,** 10.
  macroceros, **494,** 10.
  macrura, **494,** 10.
  mento, **494,** 10.
  ovata, **494,** 10.
  rotatoria, **494,** 10.
  sordida, **494,** 10.
  spicata, **494,** 10.
  tardigrada, **494,** 10.
Rousseletia corniculata, **494,** 10.
Rufipedibombus, **480,** 6.

Salix, **496,** 4, 10.
Salmo irideus, **465,** 1.
Saprolegnia, **465,** 1.
Sapromyzidæ, **474,** 5.
Sarcionus, **484,** 11.
Sarcocheilichthys kiansiensis, **499,** 3, 5.
  parvus, **499,** 3, 4.
Saropogon, **487,** 1.
  abbreviatus, **487,** 1.
  aridus, **487,** 1.
  birdi, **487,** 2, 3.
  combustus, **487,** 1, 2.
  coquilletti, **487,** 2.
  dispar, **487,** 2.
  hyalinus, **487,** 2.
  luteus, **487,** 2.
  pulcherrima, **487,** 1.
  purus, **487,** 1, 2.
  semiustus, **487,** 2.
Sauloprocta, **502,** 6.
  cockerelli, **502,** 4.
Sauropatis chloris hyperpontia, **469,** 4.
  grayi, **469,** 4.
  juliæ, **469,** 4, 6.
Scaridium eudactylotum, **494,** 10.
  longicaudum, **494,** 10.
Schistocichla leucostigma brunneiceps, **500,** 17–20.
  leucostigma humaythae, **500,** 19, 20.
  leucostigma intensa, **500,** 17–20.
  leucostigma leucostigma, **500,** 20.
  leucostigma rufifacies, **500,** 17, 20.
  leucostigma saturata, **500,** 20.
  leucostigma subplumbea, **500,** 16–20.
  schistacea, **500,** 16–20.
Schwarz, Herbert F. 'The Nest Habits of the Diplopterus Wasp *Polybia occidentalis* variety *scutellaris* (White) as Observed at Barro Colorado, Canal Zone,' **471,** 1–27.
Sciapus, **483,** 14.
Sciaridæ, **474,** 1.
Sciuromorpha, **501,** 2.
Sclateria, **509,** 1.
  naevia argentata, **509,** 4, 5.
  naevia naevia, **509,** 5.
  naevia toddi, **509,** 4, 5.
Scoloplos cirrata, **482,** 4.
Scrophularia occidentalis, **490,** 4, 5.
Seladonia, **466,** 15.
Senexibombus, **480,** 6.
Sepedon plumbellus, **474,** 7.
Serresius galeatus, **486,** 11.
Shoshonius, **473,** 13.

Simocephalus serratulus, **498**, 1.
Simpson, George Gaylord. 'A New Insectivore from the Oligocene, Ulan Gochu Horizon, of Mongolia,' **505**, 1–22.
Simulium, **498**, 6, 8.
Sinantherina, **494**, 11.
Sinanthropus pekinensis, **485**, 5.
Siniperca elongata, **499**, 3, 4.
    obscura, **499**, 3, 4.
Siphneus, **485**, 5, 7.
Smilodon, **481**, 4.
Solenopsis geminata, **471**, 22.
Solidago, **490**, 5.
Spaniotoma, **474**, 1.
Sphecodes galeritus, **466**, 13.
    gibbus, **466**, 13.
    grahami, **466**, 12, 13.
    pieli, **466**, 12, 13.
    volatilis, **466**, 13.
Sphyracephala, **463**, 2.
Squatinella leydigii, **494**, 10.
    longispinata, **494**, 10.
    mutica, **494**, 10.
    tenella, **494**, 10.
    tridentata, **494**, 10.
Stenogaster varipictus, **471**, 22.
Stephanoceros fimbriatus, **494**, 10.
Sterna bergii cristata, **486**, 9; **488**, 9.
    cristata, **486**, 9.
    mathewsi, **486**, 9.
    pileata, **486**, 10.
    sumatrana, **486**, 9.
    sumatrana sumatrana, **486**, 9; **488**, 7.
Stokesoceras, **512**, 4, 5, 9–11.
    engadinense, **512**, 4, 6, 9.
    gracile, **512**, 4.
    romingeri, **512**, 4.
Stomatorhina, **506**, 15.
Stomorhina, **506**, 15, 16, 18.
    apta, **506**, 17.
    chapini, **506**, 16.
    mitis, **506**, 18.
Streptognatha lepta, **494**, 10.
Strix delicatulus, **504**, 15.
Strongyloneura congensis, **506**, 3.
    connivens, **506**, 2.
    cupreithorax, **506**, 1.
    tristis, **506**, 2, 3.
    varians, **506**, 2.
    villeneuvei, **506**, 2.
Struthiolithus, **485**, 4.
Sumner, Ruth. See Cockerell, T. D. A.
Symphoromyia algens, **497**, 1.
    cinerea, **497**, 1.
    currani, **497**, 1, 2.
    fulvipes, **497**, 1.
    hirta, **497**, 1, 2.
    montana, **497**, 1.
    pleuralis, **497**, 1.
Symposiachrus, **504**, 23.
Synallaxis paucalensis, **500**, 23.
Synarthrus, **492**, 1.
Synchæta baltica, **494**, 10.
    johanseni, **494**, 10.
    oblonga, **494**, 10.
    pectinata, **494**, 11.
    stylata, **494**, 11.
    tremula, **494**, 11.
Syneches pusillus, **467**, 1.
Syntormon, **492**, 1.
    rotundicornis, **483**, 16, 24.
    simplicitarse, **492**, 1, 2.
    vanduzeei, **492**, 1, 6, 7.
Syrphidæ, **474**, 1.
Syrphus ambigua, **474**, 2.
    nectarinus, **474**, 1.

Tagassuidæ, **481**, 13.
Tamias, **473**, 5.
Tangiopsis tetrastichus, **510**, 15.
Tanupolama, **481**, 5, 15, 16.
    stevensi, **481**, 16.
Tanypus, **498**, 6, 8.
Tanytarsus, **498**, 4–7.
Taprocampa annulosa, **494**, 11.
    selenura, **494**, 11.
Taraxacum, **496**, 10.
Tate, G. H. H. 'Brief Diagnoses of Twenty-six Apparently New Forms of *Marmosa* (Marsupialia) from South America,' **493**, 1–14.
Taxidea, **481**, 5, 9.
    americana, **481**, 9.
Teichert, Curt. 'On the Systematic Position of the Genus *Discosorus*

Hall and Related Genera,' **512**, 1–11.

- Teleopsis, **463**, 2.
- Tephritis montana. **474**, 4.
  - parca, **474**, 4.
- Testudinella incisa, **494**, 11.
  - parva, **494**, 11.
  - parva bidentata, **494**, 11.
  - patina, **494**, 11.
- Tetanoceridæ, **474**, 7.
- Tetonius, **473**, 13.
- Tetraclænodon, **473**, 17.
- Tetralonia floralia, **466**, 8.
- Tetrasiphon hydrocora, **494**, 11.
- Teucholabis, **491**, 1, 6, 15, 16.
  - decora, **491**, 16.
  - duidensis, **491**, 1, 6, 15.
- Thermacarus nevadensis, **498**, 5, 6.
- Thionia borinquensis, **510**, 18, 19.
  - gibbicollis, **510**, 17.
- Thlæodon, **473**, 12.
- Thomomys bulbivorus, **481**, 10, 11.
  - clusius, **481**, 10.
  - quadratus quadratus, **481**, 11.
  - scudderi, **481**, 10.
  - talpoides, **481**, 10.
  - talpoides clusius, **481**, 11.
  - townsendi, **481**, 5, 10.
  - townsendi nevadensis, **481**, 10, 11.
  - townsendi townsendi, **481**, 10, 11.
- Threskiornis æthiopicus, **488**, 6.
  - æthiopicus moluccus, **486**, 6.
  - æthiopicus pygmeus, **486**, 6; **488**, 5, 7.
  - æthiopicus strictipennis, **486**, 6.
- Thryptacodon, **473**, 7.
- Tipula arecuna, **491**, 1, 4, 7.
  - bigotiana, **491**, 3, 4.
  - breviventris, **491**, 5.
  - duidæ, **491**, 1, 3–5, 7.
  - glaphyroptera, **491**, 4, 5.
  - mocoa, **491**, 4.
- Tipulidæ, **491**, 1.
- Tipulinæ, **491**, 2.
- Todirhamphus, **469**, 3.
- Torynobelodon loomisi, **470**, 11.
- Treadwell, A. L. 'A New West Indian Polychætous Annelid,' **461**, 1–2; 'New Species of Polychætous Annelids from California, Mexico, Porto Rico, and Jamaica,' **482**, 1–7.
- Trichocerca bicristata, **494**, 11.
  - bicuspes, **494**, 11.
  - capucina, **494**, 11.
  - carinata, **494**, 11.
  - curvata, **494**, 11.
  - cylindrica, **494**, 11.
  - elongata, **494**, 11.
  - flava, **494**, 11.
  - iernis, **494**, 11.
  - lata, **494**, 11.
  - longiseta, **494**, 11.
  - marina, **494**, 11.
  - mucosa, **494**, 11.
  - multicrinis, **494**, 11.
  - pusilla, **494**, 11.
  - scipio, **494**, 11.
- Trichoglossus, **488**, 11.
  - aberrans, **504**, 13.
  - ornatus aberrans, **504**, 13.
- Trichotria similis, **494**, 11.
  - tatractis, **494**, 11,
- Triclis notata, **487**, 10, 13.
- Tricyclea bifrons, **506**, 10.
  - bivittata, **506**, 9, 10.
  - confusa, **506**, 9.
  - du, **506**, 8.
  - evaneda, **506**, 7.
  - fasciata, **506**, 7, 8.
  - kasatana, **506**, 6, 7.
  - liberia, **506**, 8.
  - major, **506**, 7.
  - semithoracica, **506**, 7.
  - similis, **506**, 10.
- Trigona mosquito, **468**, 5, 6.
- Trilophodon, **470**, 10.
  - angustidens chinjiensis, **470**, 9, 10.
- Tringa hypoleucos, **504**, 5.
- Tropisternus californicus, **498**, 3.
- Trypanea sarangana, **474**, 3, 4.
- Trypaneidæ, **474**, 4.
- Tung Gur, **470**, 1, 4, 6; **485**, 4, 7.
- Tupaia, **505**, 3, 5, 7–11, 13, 14, 16, 19, 20.
- Tupaiodon, **505**, 12, 13.
- Turacoena crassirostris, **504**, 12.

Turdus leucopterus, **509**, 8.
  poliocephalus, **488**, 4, 6; **502**, 2.
  poliocephalus rennellianus, **486**, 21; **488**, 7.
Tylotrocha monopus, **494**, 11.
Tyto alba delicatula, **504**, 15.

Ugyops occidentalis, **510**, 15.
Uintanius, **473**, 13.
Uintatherium, **473**, 17.
Urocyon, **481**, 7.
Urodynamis taitensis, **504**, 14.
Urogale, **505**, 2.
Ursidæ, **481**, 8.
Ursus alexandræ, **481**, 8.
  gyas, **481**, 8.

Van Duzee, M. C. 'New South American Species of Dolichopidæ,' **483**, 1–26; 'New South and Central American Dolichopidæ,' **484**, 1–14.
Vespa crabro, **471**, 7, 8, 10, 21–23, 25–27.
  germanica, **471**, 25.
  vulgaris, **471**, 25, 26.
Viverravus, **485**, 1.
Vulpes, **481**, 4, 7.

Wanneria, **475**, 17, 19, 21.
  walcottanus, **475**, 2, 4.
Wasmannia auropunctata, **471**, 22.
Whitlock, Herbert P. 'Crystallographic Studies of Fluorite,' **472**, 1–5.
Wood, Albert Elmer. 'Phylogeny of the Heteromyid Rodents,' **501**, 1–19.
Woodfordia superciliosa, **486**, 29; **488**, 2, 5, 7.

Xenops niger, **500**, 9.
Xerophlœa viridis, **510**, 4.
Xylocopa, **479**, 9.
Xysta obtusa, **506**, 21, 22.

Zimmer, John T. 'Studies of Peruvian Birds. I' (New and Other Birds from Peru, Ecuador, and Brazil), **500**, 1–23; 'Studies of Peruvian Birds. II' (Peruvian forms of *Microbates*, *Ramphocaenus*, *Sclateria*, *Pyriglena*, *Pithys*, *Drymophila*, and *Liosceles*), **509**, 1–20.
Zosterops, **502**, 2, 26.
  aignani, **486**, 29.
  eichhorni, **486**, 28, 29.
  griseotincta rennelliana, **486**, 28.
  pallidipes, **486**, 29.
  rennelliana, **486**, 28, 29; **488**, 4, 7.
  sanctæ-crucis, **504**, 26.
  stresemanni, **504**, 1, 26

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A NEW WEST INDIAN POLYCHÆTOUS ANNELID

By A. L. Treadwell

Cirratulus pallidus, new species

A single specimen, collected at Montego Bay, Jamaica, British West Indies July 1921, by A. L. Treadwell.

The body is 125 mm. long and 5 mm. wide. The presetal region is 3 mm. long, bluntly conical in outline and 2 mm. broad at the base (Fig. 1). This presetal portion is apparently made up of two body somites and the prostomium, but because of superficial wrinkling it is difficult to determine with accuracy the somite limits. Dorsally, the prostomium has the conical outline mentioned above and has no trace of eyes. Ventrally, the first two somites, which are devoid of setæ, exhibit a flattened area which is broadest at the mouth and narrows to less than half this width at its posterior end which is on the first setigerous somite (Fig. 2). It looks as if it had a firmer texture and is less pigmented than the areas on either side of it. These latter areas are pigmented and there is, on either side of its posterior end, a much darker pigmented spot.

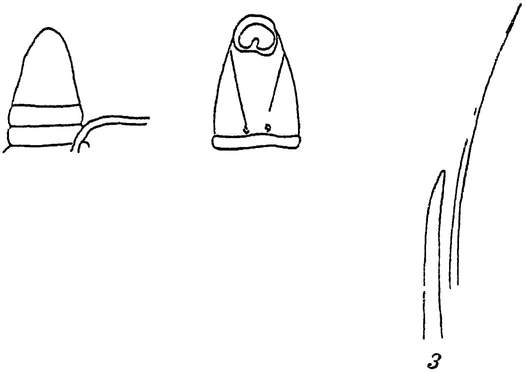

Fig. 1. Dorsal view of head, × 5. Fig. 2. Ventral view of head, × 5. Fig. 3. Hook and seta from near the middle of the body, × 68.

Gills begin on the first setigerous somite and occur on all somites for the first two-thirds of the length of the body, being entirely absent from the posterior third. The first ones are small, but those immediately following are much larger and longer.

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NEW SPECIES OF *CHRYSOPILUS* FROM THE NEOTROPICAL REGION (RHAGIONIDÆ, DIPTERA)

By C. H. Curran

All the species of Rhagionidæ which I have seen from the Neotropical region belong to the genus *Chrysopilus* Macquart. This name was proposed by Macquart in 1826, but in 1834 he changed the spelling to *Chrysopila*, the latter spelling being generally used until 1908. In 1850, Rondani proposed the name *Leptipalpus* for those species having the anal cell petiolate apically, but this character is unimportant and the name should be placed in the synonymy under *Chrysopilus*. All the species I have seen from the Neotropical region have the anal cell closed and petiolate. The females may be separated into two more or less distinct groups on the basis of the frontal width, but it is impossible to so separate the males.

It seems strange that the Rhagionidæ from tropical America should be so poorly represented in collections, but the number of specimens is very small. In no case is a species known from more than ten examples, and usually the number does not exceed two or three. In Panama I found only an occasional specimen, and these usually at widely separated localities.

In order to make the present paper as inclusive as possible, I have included descriptions of four species described by Mr. S. W. Bromley several years ago. These will be found at the end of the paper. For specimens from Porto Rico and Cuba I am indebted to Drs. M. D. Leonard and Joseph Bequaert.

The types of the new species are in The American Museum of Natural History.

Table of Species

1.—Anterior femora black or brown.................................2.
    Anterior femora reddish yellow.................................3.
2.—Third antennal segment much smaller than the second......*panamensis*, n. sp.
    Third antennal segment of about the same size as the second..............15.
3.—Anterior coxæ blackish in ground color.................................4.
    Anterior coxæ yellow.................................9.
4.—Abdomen entirely black or brown.................................5.

Abdomen broadly yellow or reddish basally 7.
5.—Antennæ wholly brown 6.
Basal two antennal segments yellowish *argenteofasciatus*, n sp.
6.—Front with moderately long, coarse, sparse black hair; stigma almost three times as long as wide .*unicus*, n. sp
Front with quite short, finer, black hair; stigma hardly twice as long as wide. *leonardi*, n. sp.
7.—Stigma entirely filling the apex of the stigmal cell *guianicus*, n. sp.
Stigma not filling the apex of the stigmal cell 8.
8.—Second abdominal segment mostly black *cubensis*, n. sp.
Second segment yellow with a small black median spot *elegans* Schiner.
9.—Wings brown with four hyaline fasciæ *fascipennis*, n. sp.
Wings not fasciate 10.
10.—Thorax with green scale-like tomentum 11.
Thorax without green tomentum . . 12.
11.—Wings dark brown; face yellowish brown *donato*, n. sp.
Wings hyaline, slightly darkened apically; face yellow *macularis*, n. sp.
12.—Wings hyaline 13.
Wings strongly tinged with brown or brownish 14.
13.—Palpi black or brown, black-haired 16.
Palpi reddish, black-haired *sericeus*, n. sp.
14.—Mesonotum with a rectangular black spot behind *rhagiodes*, n. sp.
Mesonotum wholly shining rusty yellowish *fasciventris*, n. sp.
15.—Mesonotum gray, with three black vittæ; tibiæ broadly brown basally. *stigmatias* Bigot.
Mesonotum dull black, golden tomentose; tibiæ wholly yellow. .*bequaerti*, n. sp.
16.—Abdomen wholly pale *latistigma*, n. sp.
Abdomen with the first, fifth, and sixth segments and a dorsal vitta black. *vertebratus* Bigot.

Chrysopilus panamensis, new species

Black; wings tinged with brown; tibiæ yellowish; abdominal segments with golden pile basally Length: male, 6 mm.; female, 5 mm

MALE —Head gray pollinose, in some lights shining; facial and frontal orbits opaque black; vertical triangle brown pollinose and with short, sparse, black hair. Pile of the occiput pale yellowish, the occipital cilia black. Palpi black, black-haired. Antennæ blackish, the third segment decidedly smaller than the second; arista short pubescent.

Thorax black in ground color; pleura, notopleura and the anterior border of the mesonotum bluish-gray pollinose, the mesonotum, humeri and scutellum brownish pollinose. Tomentum and hair yellowish, the tomentum black on the disc; notopleura, upper edge of mesopleura, posterior part of the mesonotum and the border of the scutellum with some coarse black hairs. Hair on the slopes of the metanotum black, the fine pile pale yellowish.

Legs blackish; coxæ cinereous pollinose and pale pilose, the apices black-haired; apices of anterior four femora and their tibiæ, yellowish, posterior tibiæ and the broad apices of the anterior four tibiæ brownish. Hair black, wholly short.

Wings hyaline, tinged with yellowish brown or gray on the apical third; veins brown. Stigma brown, about four times as long as wide, the second vein regular. Anal cell closed and petiolate at the apex. Squamæ brown, with yellow fringe. Halteres black, the basal half reddish yellow.

Abdomen sub-shining brown, with golden tomentum on the first segment and the basal half or more of the second to fourth; these segments with black tomentum on the apical half; all the segments with sparse, erect hair. Venter pale pilose on the basal half.

FEMALE.—Front wide, grayish pollinose from dorsal view, short black-haired; sulcate in the middle and with a broad depressed area extending from side to side immediately above the antennæ; from frontal view appearing blackish. Occiput brown pollinose above. Wings less conspicuously darkened apically. Ovipositor black.

TYPES.--Holotype, male, Corozal, Canal Zone, January 19, 1929; allotype, female, Corozal, January 16, 1929; paratype, female, Corozal, January 31, 1929 (Curran).

Chrysopilus bequaerti, new species

Black; femora brown with pale apices; tibiæ yellowish; wings hyaline; abdomen with golden and black tomentum. Length, 4.5 to 5 mm.

MALE. -Head brownish-gray pollinose, dull, the vertical triangle brownish. Occipital pile pale yellow, the hair on the upper third and on the palpi black. Proboscis brown; palpi black. Antennæ brown; third segment almost or quite as large as the second; arista bare or almost so.

Thorax black in ground color; pleura brownish gray, the mesonotum and scutellum grayish-brown pollinose. Mesonotum and scutellum with brassy-yellow tomentum; notopleura, posterior fourth of the mesonotum and the border of the scutellum with black hairs. Pleural pile wholly yellow.

Coxæ brown, cinereous pollinose, yellowish pilose on the basal half, black apically. Femora brown, the base and apex reddish yellow, the anterior four with pale yellowish, the posterior pair with mostly black, appressed tomentum. Tibiæ yellowish, the posterior pair slightly darker. Tarsi yellowish basally, the apical three segments brown. Hair short and black.

Wings hyaline; stigma brown, one-half longer than wide; second vein regular; anal cell closed and petiolate. Squamæ brown, with pale fringe. Halteres reddish yellow the knob black with the apex broadly yellowish.

Abdomen brownish black, dull, clothed with brassy yellow and blackish tomentum; first segment and base of the second segment pale tomentose, the remaining segments with the pale tomentum predominating, the second and third broadly blackish tomentose behind. Hair rather short and black. Venter brown, pale pilose on the basal half, the apical two or three segments and the apices of the others black-haired.

TYPES.—Holotype, male, and paratype, male, Soledad, Cuba, April 10, 1926 (J. Bequaert).

Chrysopilus unicus, new species

Black, the legs reddish yellow; tomentum whitish. Length, 4 mm.

FEMALE. -Face, lowest fifth of the front, posterior orbits and two frontal vittæ which are divergent in front of the ocelli, yellowish brown, the front and occiput brown pollinose; hair wholly black, that on the front sparse, coarse and moderately long. Proboscis and palpi blackish, black-haired. Antennæ brown, the third segment about as large as the second; arista pubescent. Front with parallel sides, widening on the posterior third.

Thorax opaque brown, the pleura and notopleura appearing opaque black in some views; tomentum of the mesonotum and scutellum very pale yellowish; hair, except the fine hair on the metanotal slopes which is brownish yellow, wholly black.

Legs yellow; coxæ black, thinly brown pollinose, black-haired; tarsi brownish apically and slightly widened; hair short, yellow on the femora, black on the tibiæ and tarsi.

Wings hyaline; stigma dark brown, almost three times as long as wide, convex apically, the stigmal cell distinctly widened; anal cell closed and petiolate. Squamæ brown. Halteres reddish yellow, the basal half of the knob brown.

Abdomen black; first segment and basal third of the three following silvery tomentose, the tomentum on the posterior part of the segments brown; hair black; basal segments of the ovipositor yellow. Venter brownish black, black-haired.

TYPE.—Female, Barro Colorado Island, Canal Zone, December 26, 1928 (Curran).

Chrysopilus leonardi, new species

Very similar in appearance to *unicus*, new species, but the front is narrower, its sides gently diverging anteriorly and less strongly diverging posteriorly, stigma shorter, etc. Length, 5 mm.

FEMALE.—Front, occiput and cheeks dark brown pollinose, the face, lower fifth of the front, posterior orbits and the border of the ocellar triangle, yellowish brown; hair of the front short. The vertex widens strongly behind the posterior ocelli. Palpi blackish, the proboscis reddish brown. Antennæ brown, the third segment about the same size as the second; arista short pubescent. Hair of the head black, that on the cheeks and lower part of the occiput tawny.

Thorax brownish red in ground color, brown pollinose, the lateral margins in front of the wings, posterior calli and two obscure dorsal vittæ more or less distinctly reddish. Tomentum and most of the hair on the mesonotal slopes very pale yellowish, Hair black.

Legs yellowish; coxæ brown, black-haired, thinly brown pollinose; apical three tarsal segments brownish. Femora pale-haired and with pale tomentum; tibiæ and tarsi with black hair.

Wings hyaline, the stigma very dark brown, not twice as long as wide, the stigmal cell conspicuously widened. Anal cell closed and petiolate. Squamæ clear, with brown border and pale fringe. Halteres with black knob, the apex and the stem reddish yellow.

Abdomen brown, brown pollinose, yellowish-white tomentose, the broad apices of the second and third segments and a median triangle on the apex of the fourth, bearing black tomentum. Hair black. Intermediate segments of the ovipositor yellowish brown.

TYPE.—Female, Puerto Real, Vieques Island, April 29, 1930 (M. D. Leonard).

Chrysopilus guianicus, new species

MALE.—Globular portion of face brownish yellow, covered with similarly colored pollen, the face elsewhere brown with yellowish-gray pollen, the small frontal triangle brownish-yellow pollinose. Beard black. Antennæ yellow, third segment brown, wider than long; arista brown, short pubescent. Vertical triangle prominent, and together with the occiput brownish-ochreous pollinose, the ground color blackish. Proboscis reddish; palpi blackish with reddish base, the hairs black.

Mesonotum opaque rusty brown with three obscure, linear darker vittæ; clothed with golden tomentum, the posterior calli with some erect black hairs. Humeri, notopleura and posterior calli luteous, the scutellum and pleura slightly darker, the latter with diffuse yellowish-brown and grayish-yellow pollen. Propleura black-haired, the mesopleura and metapleura with deep golden pile, the hairs evidently brownish apically. Scutellum with marginal row of golden-brown bristles and some golden-yellow hairs.

Legs yellow, the tarsi brown except the first segment. Wings hyaline, the stigma luteous, of moderate size. Squamæ transparent, with brown border and short fringe. Halteres reddish with brown knob.

Abdomen with the first three segments dull reddish, the fourth with a lateral reddish-yellow triangle behind, the narrow apices of the fourth and following segments reddish yellow, elsewhere opaque black. Pile golden yellow, erect, black on the black portions. Venter with the first three sternites dull reddish, the remainder black, the golden pile extending along the middle to the apex of abdomen.

TYPE.—Male, Kartabo, British Guiana.

Chrysopilus cubensis, new species

Opaque black, the base of the abdomen and the legs yellow; wings hyaline. Length, 6.5 mm.

MALE. Head grayish-brown pollinose, the facial depression and lower part of the occiput rather cinereous; facial swelling with a small white spot in the middle. Hair black, very short on the vertical triangle. Proboscis brownish red; palpi black. Antennæ brown, the second and third segments of almost equal size, the second brownish red; arista short pubescent.

Thorax apparently brownish red in ground color, the metapleura more yellowish; pollen black; tomentum sparse, short, golden red; hair black, that immediately below the squamæ yellow.

Legs yellow; coxæ brown, thinly brown pollinose, black-haired; tarsi brown, paler basally. Femora with pale hair and whitish tomentum above, the posterior pair with black tomentum on the apical fourth.

Wings hyaline; stigma short, brown, both ends transverse; stigmal cell widened; anal cell closed and petiolate. Squamæ clear, their border and fringe brown. Halteres reddish, the knob blackish with pale apex.

Abdomen opaque black, the broad apex of the first and broad base of the second segment yellow; basal two sternites yellowish. No tomentum; hair black, yellow on the yellow portions.

TYPE. Male, Soledad, Cuba, April 10, 1926 (J. Bequaert).

This species bears a close resemblance to *elegans* Schiner but that species has the second abdominal segment yellow, with a small, subapical dark spot, and the stigma much longer and rather pointed apically.

Chrysopilus donato, new species

Thorax and scutellum with greenish, scale-like tomentum; wings dark brownish; abdomen weakly fasciate. Length, 6.5 to 8.5 mm.

Male.—Head blackish, cinereous-white pollinose, the facial swelling reddish brown in ground color. Hair black on the palpi, vertical triangle and upper half of the occiput, yellow on the lower half of the occiput and proboscis. Palpi black; proboscis brownish red. Antennæ brown; third segment slightly smaller than the second; arista pubescent.

Thorax brownish, the pleura reddish with the exception of the mesopleura. Pollen on the mesonotum and scutellum brown, the tomentum green, the disc of the mesonotum with some golden-yellow hairs intermixed. Hair black, yellow in front of the halteres. Pleura gray pollinose.

Legs reddish yellow, the tarsi brown; hair black, the coxæ mostly yellow-haired.

Wings dark brownish, paler on the basal third; stigma not differentiated, the stigmal cell gradually narrowing apically. Squamæ pale brownish, with brown border. Knob of halteres dark brown, the stem reddish yellow.

Abdomen brownish red with the basal half of the second to fourth, and the whole of the following segments, brown, or with only the first segment and part of the venter reddish. Second, third and fourth segments black tomentose on the basal half. First tergite and basal four sternites brownish yellow or reddish. Hair wholly black, fairly abundant.

Types.—Holotype, male, Barro Colorado Island, Canal Zone, February 13, 1929; paratype, male, Barro Colorado Island, December 28, 1928 (Curran).

Chrysopilus macularis, new species

Differs from *donato*, new species, in having the mesonotum rusty reddish with a black prescutellar spot, pale wings, etc. Length, 7 mm.

Female.—Head blackish, the facial swelling, palpi and proboscis yellowish; hair black, on the lower half of the occiput yellow, mixed yellow and black on the proboscis. Front very narrow, opaque brown, the anterior depression cinereous; no hair except on the ocellar triangle. Occiput greenish-gray pollinose, brown above. Face not distinctly pollinose. Antennæ black, the second and third segments of about the same size; arista pubescent.

Thorax rusty reddish, the pleura mostly yellowish; a large, subrectangular spot in front of the scutellum, which emits three obscure lines extending to the anterior margin of the mesonotum, and the scutellum, except its broad posterior border, black. Hair black, partly yellow in front of the halteres and immediately below the lower lobe of the squamæ. The tomentum is scalelike and green on the notopleura and the black spot, mixed blackish and golden on the rest of the dorsum.

Legs reddish yellow, black-haired, the femora black tomentose except below; tarsi brown.

Abdomen shining black, in the middle with a broad reddish vitta which is interrupted at the sutures and does not extend behind the third segment. The tomentum is mostly golden brown but it is partly green on the first segment, forms very large, subrectangular spots on the sides of the second segment, an entire fascia across the basal fourth of the third segment and a broadly interrupted fascia on the basal fifth of the fourth segment. Hair black. Venter wholly reddish yellow, clothed with sparse, short black hair. Ovipositor wholly blackish.

TYPE.--Female, El Yunque, Loquillo Mts., Porto Rico, 2000–3500 ft., March 29, 1930 (M. D. Leonard).

Chrysopilus latistigma, new species

Rusty reddish yellow; palpi and a prescutellar spot blackish; pile golden yellowish, partly black on the abdomen. Length, 6 mm.

FEMALE.--Head dark in ground color, the orbicular facial swelling and the proboscis reddish. Pollen grayish, more or less tinged with yellow on the face, brownish yellow on the facial swelling, rather ochreous on the upper third of the occiput and the greater part of the front; from anterior view the front appears ochreous brown; on either side of the ocellar triangle is a roundish brown spot. Front moderately wide, the sides gently diverging anteriorly, strongly divergent at the vertex; hair very short, sparse, black. Occiput, proboscis and third antennal segment yellow-haired; palpi black-haired and brown in color. Antennæ reddish; third segment a little smaller than the second; arista mostly black, pubescent.

Thorax rusty reddish; pleura cinerous-yellow pollinose. Mesonotum with three slightly darker vittæ, the outer ones interrupted at the suture, and in front of the scutellum with a large brown spot; pollen thin except posteriorly. Hair and tomentum wholly golden yellow.

Legs reddish yellow, black-haired, coxæ with golden-yellow hair, the femora with yellow hair and tomentum; tarsi brown with the first segment mostly yellowish.

Wings hyaline; stigma yellowish brown, wide, convex apically, the stigmal cell widened. Squamæ clear, with pale brownish border and fringe. Halteres reddish yellow, the basal half of the knob brown.

Abdomen rusty reddish-yellow, or pale orange, with brassy-yellow tomentum-like pile, the apical two-thirds of the second and third segments black pilose, the fourth with scattered black hairs on the middle of the posterior half.

TYPE. Female, Barro Colorado Island, Canal Zone, January 4, 1929 (Curran).

Chrysopilus fasciventris, new species

Rusty reddish, the abdomen banded with black; third antennal segment pale yellow. Length, 6 to 8 mm.

MALE. -Head blackish, cinereous-white pollinose; facial swelling yellowish, the proboscis and palpi reddish yellow. Pile yellowish, the occipital cilia black. Antennæ brownish red, the third segment pale yellow, about as large as the second; arista black, pubescent.

Thorax rather shining, the pleura reddish yellow. Hair black, the propleural pile and the hair below both squamal lobes, yellowish or reddish; no tomentum.

Legs reddish yellow, the tarsi brown except basally; hair black, the coxæ pale-haired except apically.

Wings gray, the stigma yellowish brown, very long, the second vein normal. Squamæ grayish, with brown border and fringe. Knob or halteres reddish brown.

Abdomen rusty reddish, the fifth to seventh segments blackish; second segment darkened on the basal half, the third with a broadly interrupted blackish fascia on the basal third; fourth with an entire but medianly narrowed black fascia on the basal third; fifth segment with a transverse reddish spot on either side of the apical half. Genitalia brownish red. Basal four sternites reddish yellow. Pile wholly black.

FEMALE.—Front rather narrow, with almost parallel sides, in some views dull blackish, in others rather silvery white; a very few, very short, black hairs. Occiput black above, in some views partly white, the lower half cinereous white. Black fascia on the second, third and fourth abdominal segments shining, occupying the basal half, broadly excised in the middle behind; fifth segment wholly black. Ovipositor brown and yellow annulate.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, February 18, 1929; allotype, female, Barro Colorado Island, December 28, 1928 (Curran).

The following four descriptions have been prepared by Mr S. W. Bromley.

Chrysopilus fascipennis, new species (Bromley)

Small species with black thorax (golden pubescence on mesonotum, silver pubescence on pleura), pale yellow legs, abdomen yellow and brown and wings beautifully banded with brown. Length, 6 to 7 mm.

MALE.—Antennæ brownish, second segment contrastingly white pruinose. Face and clypeus white pruinose. Labrum pale yellow. Beard white. Thorax deep brownish-black. Mesonotum with fine, short appressed golden pile. Pleura with white pile and bloom. Front coxæ with rather long white hairs; other coxæ with both white and black hairs. Scutellum shining brown with a few short, fine black hairs. Postscutellum with a few silvery hairs and a scanty tuft of black hairs at sides. Legs pale yellow; tibiæ and tarsi grayish. Halteres with yellow stems and brown knobs. Wings hyaline with three broad brown bands, the first at the base, the second at about one-third of the length of the wing and the last, the largest, occupies the apical half of the wing. The third band contains four hyaline areas: a spot on the outer portion of first submarginal cell; two spots in the second submarginal cell; and the second posterior cell has over half of its exterior portion hyaline. Abdomen with silvery hairs at base; sordid white hairs along the sides. Ventral segments 1 5 yellow, rest black. Dorsal segments: first, yellow; second, yellow with median brown band; third, brown with borders yellow; fourth brown with only anterior border yellow, fifth and following, blackish brown.

TYPES.—Holotype, male, Fonteboa, Rio Negro, Brazil. Paratypes: three males, Kartabo, British Guiana, March 5, May 1, and 5, 1924.

Chrysopilus rhagiodes, new species (Bromley)

A pale brown species with wings yellow basally, grayish apically, and a conspicuous brown stigma in the apex of the marginal cell. There is a stump of vein at the base of the anterior branch of the third vein. Length, 11 mm.

FEMALE.—Mouth-parts and antennæ pale yellowish (arista brown). Rest of head dark brown. Occiput grayish pollinose, occipital bristles black. Beard scanty, pale yellow. Thorax sordid brown, pleura and coxæ paler. Mesonotum and scutellum with fine black hairs. Coxæ with pale sordid-yellow hairs. Postscutellum pale yellowish, parascutellum with pale yellowish hairs. Halteres pale yellowish-brown with dark knobs. Legs pale yellowish with gray-brown tibiæ and tarsi. Wings with brown veins; base pale yellowish; apical third and posterior border grayish; discal cell and a spot in the first submarginal cell nearly hyaline; veins bordered with brownish; a dark brown stigma in apex of marginal cell. Abdomen brown with short light brownish hairs. First segment with blackish hairs on dorsum. First tergite pale brown; second, third, fourth pale brown with dark band; fifth and following dark brown. One female from Panama has only the apical fifth of the wing grayish and no stump vein.

MALE. Similar, but abdomen lighter colored and with all the tergites banded. No stump on anterior branch of third vein.

TYPES.- Holotype, female, Barro Colorado Island, Canal Zone, February 1, 1929; allotype, male, France Field, Canal Zone, January 19, 1929 (Curran). Paratypes; female, Kartabo, British Guiana, May 12, 1924; male, British Guiana, March 11, 1913; female, Barro Colorado Island, Canal Zone November 13, 1923 (F. E. Lutz).

Chrysopilus argenteofasciatus, new species (Bromley)

Brown species with reddish eyes, hyaline wings with brown stigma, and the abdomen velvety black banded with silvery-white pilose fasciæ. Legs pale yellow with tibiæ and tarsi grayish. Length, 6 to 8 mm.

FEMALE. Head, mouth-parts and antennæ brown. Eyes reddish. Occiput grayish-brown pollinose with brown bristles. Beard whitish. Thorax dark brown, sides and coxæ paler. Mesonotum and scutellum with fine appressed yellowish-white pile. Scutellum with dark, stronger hairs along margin. Coxæ with brown hairs. Wings hyaline with brown stigma in apex of marginal cell. Parascutellum with black hairs. Legs pale yellowish-brown with tibiæ and tarsi grayish. Halteres brown with knobs darker. Abdomen deep velvety blackish-brown with fine black hairs and the anterior borders of the segments with bands of silvery-white pile.

TYPES. Holotype, female, Kartabo, British Guiana, May 18, 1924; paratype, female, Kartabo, March 5, 1924.

Chrysopilus sericeus, new species (Bromley)

A small golden species with tip of the abdomen black; wings hyaline (except for pale brown inconspicuous stigma), legs yellow, mesonotum with fine golden pubescence; eyes large dark reddish- brown above, black below. Length, 5 mm.

MALE. Eyes large, reddish-brown above, black beneath. Rest of head, including mouth-parts, yellowish. Beard and occipital hairs light brown. Thorax light golden brown, legs yellow. Mesonotum and scutellum with fine golden pubescence. Halteres yellow; knobs darker. Coxæ and pleura with yellowish hairs. Wing hyaline, veins yellow, small indistinct pale yellowish-brown stigma in marginal cell. Abdomen golden brown with concolorous hairs. Fourth tergite with brownish median spot, fifth with brown band, following tergites blackish brown. Venter yellowish brown.

HOLOTYPE. Male, Kartabo, British Guiana, April 7, 1924.

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DESCRIPTIONS OF NEW SPECIES OF *DIASEMOPSIS* RONDANI (DIOPSIDÆ, DIPTERA)

BY C. H. CURRAN

At the time of his death, Dr. E. Brunetti was engaged in the preparation of a monographic revision of the Diopsidæ, a project which had also been commenced by the author. Through the kindness of Dr. G. A. K. Marshall, the Brunetti manuscript has been in my hands for a considerable time and the notes made by Brunetti, who examined many of the types, have been of great assistance in identifying some of the older species. Unfortunately, he failed to recognize the importance of several characters, such as the extent of pollen on the thorax and the sculpturing of the front. The notes prepared by Dr. Brunetti are reserved for consideration at such time as it may be possible to prepare a thorough revision of the family. The descriptions herein published are presented in order that the names of the new species may be available in connection with a paper by Dr. Roland Thaxter, dealing with fungi attacking these flies.

The largest single collection of diopsids examined by the author was forwarded by Dr. Thaxter and contained more than three hundred specimens of *Diasemopsis*. Most of the material before me at the present time has been brought together during the past four or five years and I wish to express my appreciation to all those who have so generously coöperated in furnishing specimens. The collection received from Dr. Thaxter is to be shared by the American Museum and the Museum of Comparative Zoology. These specimens are from Cameroon, West Africa, and were collected and placed in glycerine in order to preserve any fungi attacking them. Specimens bearing fungi are recorded with a Thaxter number; all other specimens recorded from Cameroon without collector's name are from Dr. Thaxter and examples of the various species will be found in the Museum of Comparative Zoology. Unless otherwise stated, the holotypes are in The American Museum of Natural History.

TABLE OF GENERA OF DIOPSIDÆ

1. Thorax with only one pair of spines, arising on the hypopleura 2.
Thorax with two pairs of spines, the anterior pair arising on the mesonotum above the base of the wings *Teleopsis* Rondani
2. Mesonotum with a pair of intra-alar bristles 3.
Mesonotum without intra-alar bristles *Diopsis* Linnæus.
3. Scutellum longer than deep, without bristles 4.
Scutellum very short, as deep as long, with a pair of erect, black bristles on the disc *Diopsina* Curran.
4. Eye-stalks little longer than wide, frontal bristles at base of eye-stalks. *Sphyracephala* Say.
Eye-stalks several times longer than wide, the bristles situated on the eye-stalks, near or beyond the middle *Diasemopsis* Rondani.

Diasemopsis Rondani

This genus was originally established for species having a bristle at the tip of the scutellar spines. However, the bristles break off very easily and evidently some of the species lack them. The presence of a mesonotal bristle near the posterior calli, absence of scutellar bristles, and elongate eye-stalks are the characters distingushing *Diasemopsis* from the other genera of the family. Even though the mesonotal bristles may be broken off it is usually possible to see the scar. The genus itself may be divided into two distinct groups: viz., (*a*) oral margin with a strong tooth on either side; (*b*) oral margin unarmed, notopleural bristle present or absent.

Diasemopsis æthiopica Rondani is the type of the genus and belongs to the second group. The notopleural bristle is seldom strong and the character can be used only specifically, and even so, the scar left by this bristle, when broken off, is not always easy to see. Owing to the fact that the presence of the notopleural bristle has been mentioned by only two authors it is not possible to use it as a character for the separation of groups and I have been forced to ignore it, since the genus contains several species known to me only from description.

It will be noted that I have included both *dubia* Bigot and *incerta* Eggers in the key to species although I feel fairly certain that both names refer to the same species. Doubt as to the identity of *dubia* exists, since Brunetti retained it in *Diopsis* and Mr. Collin, in whose collection the type is to be found, furnished notes (to Dr. Brunetti) indicating the absence of the mesonotal bristles. Nevertheless, the description indicates that *dubia* belongs to *Diasemopsis* and I suspect that the bristles have been broken off. Should *dubia* prove to be a true *Diopsis*, the species herein recorded would be known as *incerta* Eggers; on the other hand, if both belong in *Diasemopsis*, the name *incerta* should probably be considered a synonym of *dubia*.

I have redescribed the species which I feel certain is *æthiopica* Rondani and included a list of the synonyms. Redescriptions of the other species and detailed illustrations are reserved for the revision of the family as a whole. The following species, described by Brunetti, are not included in the key: *apicifasciata*, *fuscapicis* and *sexnotata*.

TABLE OF SPECIES

1. Collar (prothorax) reddish or yellowish. . . . . 2.
Collar black or brown. . . . . 8.

2. Wings distinctly fasciate across the middle, the fascia usually connected with the brown clouded anterior cross-vein. . . . . 4.
Wings not fasciate across the middle . . . . 3.

3. Abdomen dull yellowish brown, not spotted with white. . *macrophthalma* Dalman.
Abdomen yellowish brown, with white spots and bands. . . . *signata* Dalman.

4. Mesonotum wholly shining. . . . . *pulchella* Eggers.
Mesonotum pollinose at least on the anterior half. . . . . 5.

5. Front with several transverse, arcuate depressions in the middle . . *horni*, n. sp.
Front without transverse grooves. . . . . 6.

6. Mesonotum practically entirely pollinose, only the sutures bare. . . . . . . 7.
Mesonotum shining on more than the lateral third behind the sutures. *quadrata*, n. sp.

7. Fourth abdominal segment wholly pollinose. . . . . *albifacies*, n. sp.
Fourth abdominal segment with an interrupted shining fascia occupying more than the posterior half. *interrupta*, n. sp.

8. Facial teeth present, though they may be small. . . . . 9.
Facial teeth absent. . . . . 15.

9. Wings with a narrow, incomplete median brownish facia. . . . . 10.
Wings with a very broad median fascia, longitudinally streaked, with apical spot, or unicolorous. . . . . 11.

10. Femora reddish yellow. *breviseta* Bezzi.
Femora reddish brown or black, the anterior pair sometimes largely brownish red. . . . . *meigenii* Westwood.

11. Wings brownish across the middle and with a large, brown apical spot. *coniortodes* Speiser.
Wings differently colored. . . . . 12.

12. Head black. . . . . *robusta* Brunetti.
At least the face reddish or yellow. 13.

13. Facial spines long and strong. . . . . 14.
Facial spines short (*fucata* Macquart, ♂). . . . . *terminata* Macquart.

14. Middle of front carinate, polished castaneous, without trace of pollen. . . . . . 29.
Middle of front very gently convex, and thinly covered with whitish pollen. *elongata*, n. sp.

15. Collar at least broadly shining black laterally or in front. . . . . 16.
Collar with at most a linear lateral shining black stripe. . . . . 24.

16. Abdomen with well-developed pale fasciæ or shining spots.............. ....17.

Abdomen with at most traces of pale, narrow apical fasciæ on segments three and four. . ... .22.

17. Humeri mostly shining; bristle on eye-stalks always long and strong . . .19.

Humeri opaque brownish or the bristle on the eye-stalks minute... .18.

18. Bristle of eye-stalks short and weak. .. ..*æthiopica* Rondani.

Bristle of eye-stalks long and strong . . . .31.

19. Front with one to three transverse, arcuate ridges above . . . . 30.

Front with longitudinal grooves and ridges........ .. . . . .20.

20. Median and apical brown markings of the wing broadly separated ....21.

Median and apical brown markings of the wing very broadly connected along the third vein. ....*conjuncta*, n. sp.

21. Anterior femora greatly swollen.. .. ..*pleuritica*, n. sp.

Anterior femora not greatly swollen .. ..*nebulosa*, n. sp.

22. Wings almost uniform in color, a little darkened apically . *concolor* Westwood.

Wings brownish in the middle.........................23.

23. Front tarsi brown......... . . ..*subfuscata* Brunetti.

Front tarsi uniformly reddish yellow; notopleural bristle long..*hirsuta*, n. sp.

24. Notopleural bristle absent. ....25.

Notopleural bristle present. ....*æthiopica* Rondani

25. Fourth abdominal segment black, uniformly thinly white pollinose.
obstans Walker.

Fourth segment with contrasting colors......... .... .26.

26. Pale abdominal fasciæ on the intermediate segments strongly widened laterally or strongly narrowed or interrupted in the middle.. .... 27.

Pale fasciæ only a little widened laterally........... ..... .*fasciata* Gray.

27. Wings with a sharply defined apical spot on the third vein. . .*silvatica* Eggers.

Wings, if darkened at the apex, diffusely so.............................28.

28. Scutellar spines arising at an angle of about 45°....... ....*dubia* Bigot.

Scutellar spines arising at an angle of less than 45°...........*incerta* Eggers.

29. Expanse of eye-stalks at least 3 mm. greater than length of body.
longipedunculata Brunetti.

Expanse of eye-stalks at most 1 mm. greater than length of body.
disconcerta, n. sp.

30. Front with two or three transverse, arcuate ridges below the ocelli.
amorus, n. sp.

Front with one transverse, broad ridge below the ocelli; wings not distinctly banded.................... ....*thaxteri*, n. sp.

31. Front with a longitudinal ridge; wings strongly clouded across the middle.
dejectus, n. sp.

Front with transverse, arcuate striæ and carinæ; wings faintly clouded across the middle................ .. ..*munroi*, n. sp.

Diasemopsis horni, new species

This species apparently is most closely related to *pulchella* Eggers but the abdomen shows a more extensive white pollinose pattern and the mesonotum is brown pollinose in front of the suture except on the sides. The presence of arcuate frontal grooves at once separates *horni* from the three related species herein described. Unfortunately no detailed description of the front of *pulchella* was given by Eggers and the type must be examined in order to determine the exact status of the species. The length of *horni* is from 4.25 to 5 mm., the width of the head from 2.5 to almost 3 mm.

MALE. Head varying from ferruginous reddish to ferruginous, the ocellar triangle and apices of the eye-stalks blackish, the cinereous pollen quite thin; hair moderately abundant and fairly long. Eye-stalks of moderate length and rather thin, the setigerous tubercle almost as long as wide, the seta long and strong; post-ocular seta strong. Antennæ dull reddish, the arista mostly black. Immediately in front of the ocellar triangle is a low tubercle which bears on either side a roughened pit; in front of the tubercle three anteriorly arched, broad, roughened grooves are very conspicuous. Proboscis and palpi pale ferruginous.

Thorax black or castaneous, the anterior half of the mesonotum brown pollinose except on the sides; anterior third of the pleura thinly white pollinose; scutellum densely reddish-brown pollinose. Scutellar spines long, sub-erect, strongly curved backwards near the apex; no setæ present on the specimens before me.

Legs rusty reddish, yellowish or pale ferruginous, the posterior femora very broadly darker apically; anterior four coxæ and usually the tarsi, yellowish. Anterior femora moderately swollen, the two ventral rows of stout setæ not extending quite so close to the base as usual; two posteroventral and three anteroventral bristles on the apical third, the hair quite long and fairly abundant.

Wings hyaline; anterior cross-vein, a narrow, short fascia extending over the posterior cross-vein but not reaching the second vein, and the apex of the wing between the second and fourth veins, amber or brownish-amber in color. Halteres reddish yellow.

Abdomen blackish or castaneous, with brown and white pollen. First segment brown pollinose, the anterior third shining on the sides, in the middle with a large, oval, white pollinose spot on the anterior half, behind with a subrectangular white spot in the middle, the sides broadly shining. Second segment brown pollinose, at the base with a median subcordate white spot which is continued backward as a slender median line, at either side of the apex with a large, subrectangular, slightly oblique white spot. Third segment brown pollinose on the basal half, the apical fifth white pollinose except at the sides; sides in front also shining. Fourth and following segments shining, the fourth with a subtriangular basal spot of white pollen on either side.

FEMALE. Differs only sexually.

TYPES.—Holotype and allotype, Cameroon. Paratypes: male, Victoria, Cameroon (Preuss), two males, Cameroon (Conradt), in Deutsches Entomologisches Museum; two males, Sa Jsabel, Fernando Po, February 9, 1900 and March 12, 1900 (L. Conradt); male, Arebi (Bondo Mabó), Congo, July 26, 1925 (H. Schouteden), in Musée du Congo Belge; two males, Cameroon.

It gives me pleasure to name this pretty little species in honor of Dr. Walther Horn, who has furnished me with much material belonging to the Diopsidæ.

Diasemopsis quadrata, new species

This species is readily distinguished from *pulchella* Eggers by the medianly and anteriorly pollinose mesonotum and the characters given in the key will prove sufficient for its recognition. Face pale yellow; thorax brown; abdomen blackish and pale reddish, with white markings. Length, about 4 mm.; width of head, about 2.35 mm.

FEMALE.—Face yellow, white pollinose; front brownish yellow, with thin whitish pollen. Eye-stalks rather short and thick, ferruginous above, brown below, the base white pollinose dorsally, thinly brown pollinose elsewhere; dorsal median tubercle small, the seta long; postocular tubercle very small (the seta broken off). Antennæ brownish yellow, the third segment pale pollinose; arista brown, its base broadly yellowish. Front smooth, with a very weak, raised median line; face gently convex in profile, protuberant below, not conspicuously concave above the oral margin; teeth absent. Head practically without hair; proboscis and palpi yellow.

Thorax shining brown, the mesonotum in front of the suture, a broad median vitta behind the suture, the humeri and the scutellum, brown pollinose; pleura below and posteriorly, obscurely pollinose. Collar brownish red, darker behind. Scutellar spines reddish brown, long, gently curved; scutellum with very few hairs.

Legs reddish yellow, coxæ reddish brown, the anterior pair paler. Femora brownish as follows: basal third of the anterior pair, the middle pair except a broad median band, and the posterior pair on the second and last fourth; posterior tibiæ brownish on the basal third. Anterior femora strongly enlarged, beneath with the usual short, stout setulæ forming two rows on the apical three fourths, and a row of bristles on either side of the apical half.

Wings hyaline, with amber-colored markings. The fascia at the middle of the wing is very broad, extending between the anterior and posterior cross-veins, narrowed in front where it scarcely reaches the second vein, and more or less broadly separated from the posterior margin of the wing; the diffuse apical darkening extends broadly between the second and fourth veins.

Abdomen brown, ferruginous and yellowish in ground color, mostly pollinose. First segment brown pollinose, the posterior fourth white, the anterior and posterior corners each bearing a large, subrectangular shining spot; second segment dull brown, with an incomplete, broad whitish fascia in front and large, somewhat tessellate, subquadrate spots on the posterior corners, in front with a subquadrate shining basal spot, the sides shining on the posterior third. Third segment reddish brown, almost the posterior third whitish, the white color produced broadly forward in the middle almost to the basal third of the segment. Fourth segment yellowish, and with brownish-ochreous pollen, basally with a very large whitish spot which extends along the sides to the apical fourth of the segment and inwardly to the median fifth, the inner ends pointed, the posterior border gently convex. Fifth and sixth segments shining rusty reddish or pale ferruginous. Venter yellowish brown, thinly pollinose.

Described from one female from Cameroon, Africa (Thaxter No. 2715).

Diasemopsis albifacies, new species

This species is most nearly related to *quadrata* but the wholly brown pollinose mesonotum at once distinguishes it, while the face is also much paler in color. Length, 5 to 5.5 mm.; width of head, 3.5 mm.

MALE. Head pale yellow, whitish pollinose; face broad, gently convex in profile, longest below, unarmed; front smooth. Eye-stalks brown to black, very thinly brown pollinose; tubercle situated near the basal third, not as long as wide, the seta very long; postocular seta strong; antennæ reddish, the arista mostly black. Ocellar triangle black. Proboscis and palpi yellow. Face slightly concave just above the oral margin, with moderately abundant pale yellowish hair.

Thorax dark ferruginous, the mesonotum and scutellum thickly brown pollinose; collar reddish yellow. Scutellar spines more or less reddish on the apical two-thirds, long and gently curved.

Legs reddish yellow; coxæ, anterior trochanters, base of anterior femora, a broad, preapical band on the anterior four femora, and the basal fourth of the posterior tibiæ, brownish, the posterior four femora sometimes brownish on the basal third or more. Anterior femora strongly swollen, with the usual two rows of stout ventral setæ and with bristles on the apical half of the anteroventral and posteroventral surfaces, the posteroventral surface with three fine bristly hairs on the basal half.

Wings hyaline, with amber colored fasciæ. The median fascia rises at the second vein and extends almost to the posterior border of the wing, being expanded in the middle so that it extends between the anterior and posterior cross-veins; apex of the wing broadly dark amber-colored between the second and fourth veins. Halteres reddish.

Abdomen brown and yellowish, with brown, white and brownish-yellow pollen. First segment brown pollinose, broadly shining in front and on the lateral third behind, the posterior fourth white pollinose on the median third or slightly more. Basal fourth of the second segment and a very large, subtriangular spot on either side apically, white pollinose, the small anterior triangles shining, the segment mostly brown pollinose. Third segment brown pollinose on the basal two-thirds, the apical third pale in ground color and with pale-yellow pollen which is produced broadly forward to the basal third along the median line. Fourth segment mostly pale in ground color and with brownish-yellow pollen, the anterior angles each bearing a large, transverse, yellow pollinose area. Fifth and sixth segments shining ferruginous.

FEMALE. Differs sexually.

TYPES. Holotype, male, Cameroon, allotype, female, Sa Jsabel, Fernando Po, February 9, 1900 (L. Conradt), in Deutsches Entomologisches Museum. Paratypes: female, Cameroon (Conradt), in American Museum of Natural History; female, Mayumbe, Makaia N'Tete, Congo, July 1917 (R. Mayné), in Musée du Congo Belge; and three males, Cameroon.

Diasemopsis interrupta, new species

The characters in the key are sufficient for the ready recognition of this pretty little species. The head bears rather numerous long hairs and the coxæ and femora are darker than in related species, while the mesonotum is wholly brown pollinose. Length, 4 mm.; width of head almost 3 mm.

MALE,—Head and base of eye-stalks reddish yellow, the middle of the front somewhat brownish, the whole pale pollinose; eye-stalks brown, becoming black apically, clothed with brown pollen and sparse hair; median seta-bearing tubercle very strong, three times as high as thick, the seta long and gently curved; postocular seta strong. Antennæ luteous, the long arista black except at its base. Front without ridges or depressions; face gently convex, most prominent below, without teeth. Proboscis and palpi yellowish.

Thorax shining black, the pleural spines brownish red; mesonotum and scutellum densely brown pollinose; scutellar spines brownish, becoming brownish red apically, long and curved, the apical bristle missing.

Coxæ and femora reddish brown, the trochanters, bases of the femora and the tibiæ and tarsi reddish yellow, the posterior tibiæ somewhat darker than the others. Anterior femora rather strongly swollen, beneath with two rows of short setæ extending from near the base to the apex, anteroventrally with three or four long bristles, posteroventrally with a row of bristles and bristly hairs on the whole length; all the femora with fairly long hair.

Wings cinereous hyaline and hyaline, with brownish-amber markings. The dark markings form a cloud along the anterior cross-vein, an incomplete, moderately broad fascia bordered exteriorly by the posterior cross-vein and a cloud on the apex of the wing which is darkest between the second and third veins but extends distinctly to the fourth. Halteres yellow.

Abdomen black or brownish black, with brown and white pollen. First segment shining black on almost the anterior third, the apex broadly white pollinose in the middle, with a rectangular shining black spot on either side, the median half brown pollinose, but in some lights with a whitish sheen. Second segment blackish pollinose, in some lights with a whitish sheen, a large, suboval basal spot and a large, subrectangular apical spot on either side, white, the sides in front and posteriorly, shining black. Third segment brown pollinose, with conspicuous whitish sheen, the apical, third white pollinose, the pale band excised in the middle by an anterior triangle which extends half-way to the posterior border; posterior corners of the segment shining brown or reddish. Fourth segment shining brownish red, the basal half whitish pollinose laterally, more brownish yellow in the middle, sometimes with the narrow apex and a median triangle also pollinose. Fifth and sixth segments shining black, the fifth with a white triangle on either side at the base. Venter brownish, the apical three sternites pale pollinose.

Female.—Differs only sexually.

Types.—Holotype, male, Cameroon (Thaxter No. 2720); allotype, female, Cameroon; Paratypes: four males and one female, Cameroon.

Diasemopsis elongata, new species

An elongate, slender species; the head reddish; thorax black; abdomen brown; wings brownish yellow, brownish on the apex; oral spines long, horizontal. Length, 5.5 to 7.5 mm. Width of head: male, 5.5 to 11 mm.; female, 5.4 to 8 mm.

Male.—Head rusty reddish, the vertex and eye-stalks reddish brown, the frontal groove black. Front with a broad, median raised area extending from the ocelli to the frontal groove and with two broad, low ridges on either side. Ocellar tubercle black. Face most prominent at upper fourth, receding below; oral spines and palpi reddish brown. Spines of the eye-stalks strong. Antennæ reddish, with black arista.

Mesonotum, scutellum and almost the upper half of the pleura, brown pollinose, the pleura below and the pectus with gray pollen. Prothorax rather long, shining black except on the sides, the humeri narrowly shining behind. Hair of thorax fine, pale, not conspicuous, notopleural bristle slender. Spines of thorax and scutellum brown, the latter sometimes reddish in the middle, with sparse black hair, twice as long as the scutellum, straight, the apical bristle fine, two-fifths as long as spine.

Legs shining rusty reddish, the coxæ and broad base of femora, yellow; femora with brown tinge on apical fourth; anterior and posterior tibiæ with a broad, basal and apical brown band, the middle tibiæ somewhat darkened basally. Tarsi reddish yellow, the anterior tarsi pale yellowish with the basal segment reddish brown.

Wings with strong luteous tinge, the middle darkened on its whole length, the apex broadly brownish.

Abdomen brown pollinose, the apices of the segments less thickly pollinose or with brownish yellow pollen, rarely the second and third segments very narrowly yellowish, the apical segments less thickly pollinose on sides, the anterior margins of the third and fourth segments broadly almost bare on the broad sides. Genitalia yellowish brown.

FEMALE. Differs in having shorter eye-stalks.

TYPES. Holotype, male, Lenga Town, Liberia, August 15, 1926; allotype, female, Cameroon. Paratypes: male, Du River Camp No. 3, Liberia (Jos. Bequaert); male, Kikionga, Mayumbe, Congo, July 24, 1926 (A. Collart), in Musée du Congo Belge; and eleven males and twelve females, Cameroon.

Diasemopsis disconcerta, new species

Related to *elongata* new species, but with the humeri shining black, the eye-stalks shorter and with a shining median frontal carina which has no trace of pollen. Length, 7 mm. Width of head; male, 8 mm.; female, 6.5 mm.

MALE. Head dark reddish, thinly pale pollinose, sparsely haired; frontal seam and the posterior part of the ocular swelling black. Face gently concave, as prominent above as at the gently produced oral margin; oral spines long and strong, almost horizontal, brown in color. Front with about five longitudinal, broad low convex areas, the median ones most prominent, those at the base of the eye-stalks rather weak. Swollen part of eye-stalks brown pollinose; postocular bristle present. Antennæ dull reddish yellow, the basal segments darkened. Palpi and proboscis yellowish.

Thorax black; mesonotum thickly brown pollinose; humeri and collar shining black; pleura cinereous pollinose, the mesopleura with the pollen mostly brown. Spines of scutellum ferruginous, apparently without apical seta.

Legs reddish; posterior four coxæ brown, the apices of the tibiæ more or less brownish. Anterior femora moderately swollen, the tiny robust setulæ limited to the apical four-fifths, each side of the ventral surface with three bristles on the apical third.

Wings tinged with brownish yellow, the apex broadly brownish. Halteres yellow.

Abdomen brown, thickly brown pollinose; tips of second and third segments and the broader bases of the third and fourth, thinly gray pollinose, subshining. Venter cinereous pollinose.

FEMALE.—Wings with brownish clouding along the third vein; gray segmental incisures narrower, not conspicuous.

TYPES.—Holotype, male, Liberia (Thaxter No. 3591); allotype, female, Cameroon (Thaxter No. 2716). Paratypes: female, Cameroon (L. Conradt), in Deutsches Entomologisches Museum; nine males and eight females, Cameroon.

Diasemopsis dejectus, new species

Related to *æthiopica* Rondani but at once distinguished by the long, strong bristles on the eye-stalks. In *athiopica* these bristles are very short and weak. Length, 5.75 mm.; width of head, 4.5 mm.

FEMALE.—Head brown, cinereous pollinose; eye-stalks and sides of head ferruginous, the apex black, their thin pollen brownish. Front with three broad longitudinal depressions, the median carina rather strong, the other raised areas only slightly convex and broad. Bristle of the eye-stalks strong, situated half-way between the base and the base of the antennæ on a low tubercle; postocular bristle strong; antennæ dull reddish, brown above, the arista brown except basally. Face most prominent at the upper fourth, scarcely receding below, the oral margin not produced. Proboscis and palpi reddish. Head with short, sparse hair.

Thorax black; mesonotum, scutellum and upper border of the pleura brown pollinose, the pleura cinereous pollinose except above. The brown pollen is of two shades, the darker shade forming a pair of broad, narrowly separated median vittæ and two roundish spots on either side. Scutellar spines reddish, elongate, with a very short apical seta.

Coxæ, basal two-thirds of the posterior four femora, apical two-thirds of the middle tibiæ and a broad median band on the posterior pair, reddish yellow; anterior femora, apical third of the posterior four tibiæ, basal third of the middle tibiæ and the anterior and posterior pair, and the basal two or three segments of the tarsi brown or brownish, the apical tarsal segments reddish; anterior femora perhaps more brownish red than brownish, greatly swollen, with the usual bristles and sparse hair.

Wings cinereous hyaline with extensive yellowish-brown markings. Across the middle of the wing the brown markings begin in front as a narrow fascia and spread in the discal cell so as to extend from a point well before the anterior cross-vein to the posterior cross-vein and are continued in the apical cell to the apex of the wing; the veins reaching the wing margin are broadly clouded with brown for a considerable distance, the color being more intense at the apices of the veins. Halteres pale yellow.

Abdomen brown, brown and white pollinose, the lateral margins more or less shining. The base of the second segment bears a laterally widening white pollinose fascia which scarcely reaches the base in the middle and is more widely separated laterally, while, on either side of the posterior border is a transverse, rather hemicircular white spot which is moderately separated from the lateral margins. Third segment on either side in front with a rather small, transverse, subtriangular white spot; on the posterior border with a narrow, laterally tapering, broadly interrupted white fascia. Fourth segment on the basal half of each lateral third with a rectangular reddish spot covered with whitish pollen, the fifth segment with a basal white pollinose triangle on either side. Sixth segment reddish in the middle and at the apex.

TYPE.—Female, Elisabethville, Lubumbashi, Congo, July 22, 1920 (Dr. M. Bequaert), in Musée du Congo Belge.

Diasemopsis munroi, new species

Related to *dejectus*, new species, but the front bears numerous anteriorly convex grooves and ridges in front of the ocelli and the median cloud on the wings is only faintly indicated. Length, 5 to 5.3 mm.; width of eye-stalks, 3.5 to 4 mm.

FEMALE.—Head reddish brown, thinly cinereous pollinose, the hair short and fine. Bristle of the eye-stalk strong, situated closer to the antennæ than to the base of the stalk; postocular bristle long. Antennæ reddish, broadly brown above. Broad middle of the front in front of the ocelli with many anteriorly arched, narrow ridges. Face most prominent at the middle, the oral margin slightly produced; face wide above. Palpi brown.

Thorax black, the dorsum brown, the pleura cinereous pollinose; no notopleural bristle. Scutellar spines brown, their setæ half their length. Prothorax with the sides and anterior border broadly shining black.

Legs brownish red, the femora darker apically, the tibiæ reddish brown, the anterior pair blackish; tarsi yellowish, the two basal segments of the anterior pair brown. Anterior femora very strongly swollen, and with more brownish tinge than the others.

Wings cinereous hyaline, the apical fifth brownish; along the veins on the middle of the wings faintly clouded with brown. Halteres pale yellow.

Abdomen blackish, thickly brown and white pollinose, the white pollen tessellate. First segment brownish yellow, with a dark median vitta. Second segment with the basal two-fifths, the very broad sides and a very large spot on either side behind, white pollinose, but only appearing partly white from any given angle. Third segment with a broadly interrupted basal band and very broad, transverse spots on the posterior border, whitish, the posterior spots oblique on their inner border and very narrowly connected on the apex of the segment. Fourth segment mostly white, the broad apex and median line brown; the following segments with yellowish brown pollen. On account of the tessellate nature of the white pollen only part of the areas described as white will appear white from any given angle. In certain views the pollen is quite silvery.

TYPES. Holotype, female, Barberton, Transvaal, October 10, 1919 (H. K. Munro). returned to Mr. Munro; paratype, female, Barberton, August, 1913 (L. S. Hardenberg), in American Museum of Natural History.

Diasemopsis amorus, new species

Superficially very simliar to *obstans* Walker but at once distinguished by the mostly shining thorax. In *obstans* the mesonotum is opaque brownish and the apical abdominal segments have a slight cinereous sheen. The front in the two species is very similarly marked. Length, 5 to 5.6 mm. Width of head: male, 5.5 to 6.75 mm.; female, 4 mm.

MALE. Head brown, thinly whitish pollinose; middle and upper border of the face and the sides of the head posterodorsally, reddish. Front in the middle crossed by two broad, anteriorly arched grooves on the upper half, the middle more or less strongly longitudinally carinate; on either side with two rather deep grooves. Eye-stalks brown pollinose apically, the bristle arising from a very low tubercle; post-ocular bristle long. Antennæ dull reddish, the third segment above, and the arista, brown. Face most prominent just below the middle, slightly concave on lower half, sparsely haired. Proboscis and palpi brownish.

Thorax black, the mesonotum slightly dulled, its posterior border and the scutellum brown pollinose; pleura cinereous pollinose; collar shining black above. Scutellar spines long, ferruginous, apparently without bristle.

Legs brownish red or ferruginous, the coxæ trochanters, base of the posterior four femora and the apical tarsal segments, yellowish; tarsi reddish basally. Anterior femora rather slender, with very fine sparse hair and the usual bristles.

Wings hyaline, the apical fourth and a broad median band amber-colored or pale yellowish-brown; the median fascia is narrow between the third and fourth veins but in the two following cells it extends from the posterior cross-vein to slightly inside the anterior cross-vein. Halteres pale yellow.

Abdomen black, with black and white pollen, the lateral margins and apical segments shining black. The juncture of the first and second segments bears a very broad white band which is wider in the middle than the preceding opaque fascia and is strongly narrowed laterally. Apex of second segment, in conjunction with the extreme base of the third segment laterally, with a very large, subtriangular white spot on either side which is divided into two distinct sections, each of which appears silvery from a different angle. Third segment shining black on the apical two-thirds, the apex rather narrowly white pollinose. Fourth, fifth, and sixth segments shining black, the fourth with a large, basal whitish triangle on either side. Venter brown, the apices of the second and third segments broadly cinereous.

FEMALE.—Shows only sexual differences.

TYPES.—Holotype, male, allotype, female, and one male paratype. Umtali, Southern Rhodesia, September, 1927 (Alexander Cuthbertson). The paratype has been returned to Mr. Cuthbertson.

Diasemopsis thaxteri, new species

Related to *amorus* new species but at once distinguished by the practically unicolorous wings and the presence of a single, broad transverse ridge immediately in front of the ocellar triangle. Length, 6 mm.; width of head, 5.8 mm.

FEMALE.—Head blackish brown, with dark reddish areas, the face and front cinereous pollinose; eye-stalks reddish, the apex black, brown pollinose; bristle of the eye-stalk, long, arising from a low tubercle; postocular bristle strong. Antennæ reddish, brown above. Front with a low, broad, transverse swelling immediately in front of the ocelli and on either side with two distinct, but low, approximate ridges. The broad central portion of the front is rather shining and is bordered by the ridges which are pollinose. Face convex, most prominent just below the middle, the oral margin not at all produced; hair short and fine.

Thorax castaneous, the dorsum blackish in ground color. Pollen cinereous, the broad middle of the mesonotum and the posterior border, brown. Prothorax shining except below; scutellar spines dark reddish. Notopleural bristle weak, yellowish.

Coxæ, basal half or more of the posterior four femora, practically all of the front pair, middle tibiæ and all the tarsi except the first segment of the anterior pair, yellowish; femora apically, anterior tibiæ and first segment of their tarsi and the posterior tibiæ, except the base and a broad median band, reddish brown or brownish red. Anterior femora strongly swollen.

Wings cinereous hyaline, with a slight grayish or luteous tinge on the apical half, but almost unicolorous. Halteres very pale yellowish.

Abdomen blackish in ground color, yellowish-brown pollinose, the fourth and following segments with thin, cinereous pollen, the entire broad sides of the abdomen appearing cinereous or whitish in some lights; there are rather poorly defined whitish fasciæ on the segmental incisures between the first and fourth segments, the bands strongly widening laterally where they more or less clearly fuse with the pale pollen of the sides.

TYPES. Allotype, female, and one paratype, Gross Batangan, Cameroon.

Diasemopsis pleuritica, new species

Related to *nebulosa* but with the anterior femora greatly swollen and differently colored abdomen. Length, 6 mm.

FEMALE.- Head shining brown, the eye-stalks dull rusty brown above. Front rather smooth, with distinct longitudinal ridges on lower half toward the sides; face evenly convex; palpi deep brown; hair short, fine, erect. Antennæ reddish, the third segment brown above; arista black. Bristles of eye-stalks strong, the median one arising from a strong tubercle.

Mesonotum brown pollinose, the prothorax, a large spot extending from the humeri to the suture, a large, ventrally convex spot on the mesopleura and the sternopleura largely, shining brown; pleura gray pollinose. Hair not conspicuous, notopleural bristle extremely weak or absent; intra-alar bristle fine. Hypopleural spines long, brown; scutellar spines brown, twice as long as the scutellum, the fine apical bristle about one-fourth as long as spine.

Legs reddish; coxæ, base of femora and apical four segments of front tarsi yellow; posterior four femora on the apical third, all the tibiæ and the basal segment of anterior tarsi, brownish.

Wings cinereous hyaline, with very faint, large median cloud and a streak behind the anal cell, brownish tinged; apex of wing broadly brownish, the brown color extending toward the base behind the third vein and quite weak behind the fourth vein.

Abdomen opaque brown; broad sides of first and second segments, sides of the third segment more broadly behind and the lateral third of the remaining segments, shining brown. Second segment with two oval, oblique, medianly contiguous spots and a large transverse, anteriorly convex spot on either side posteriorly, chalky white; the base of the third segment with long, transverse basal triangles, similar but much smaller spots on the posterior border and larger, less triangular spots on the base of the fourth segment, chalky white. Venter with yellowish brown pollen.

HOLOTYPE. Female, Zambi, Congo (Dr. J. Bequaert), in Bequaert collection.

Diasemopsis nebulosa, new species

Blackish, the head reddish brown; legs largely reddish yellow. Length, 5 to 7.5 mm. Width of head: male, 4.25 to 8 mm.; female, 4 to 6 mm.

MALE. Head reddish brown or dark brownish-red, thinly brown pollinose, the front and lower part of the face and cheeks shining; hair brownish, fine and rather short. Eye-stalks with the median bristle long and strong, arising from a strongly raised tubercle, the bristle behind the eye rising from a low tubercle and strong. Front with a strong, broad ridge extending from the ocelli to the anterior margin and indications of two broad lateral ridges; face prominent in the middle, gently concave below; oral spines absent. Palpi brownish red or reddish. Antennæ reddish, the third segment brown above; arista black.

Thorax with brownish pollen, the propleura and a spot on the anterior upper corner of the mesopleura shining black; a broad band extending over the mesopleura to the anterior coxæ, the pectus and posterior half of the sternopleura gray pollinose. Hair sparse, fine; notopleural and intra-alar bristles fine; scutellar spines, brown, twice as long as scutellum, the apical bristle fine, about one-third as long as spine. Hypopleural spines brown, long and pointed.

Coxæ and basal half to two-thirds of the femora reddish yellow, the apical third of the femora brown or ferruginous, the posterior pair sometimes dark almost to the base on the anterior and posterior surfaces, the apices of all the femora reddish. Anterior tibiæ black or ferruginous, the posterior pair, except the base and a median band, the first segment of the front tarsi and an obscure, broad sub-basal band on the middle tibiæ, ferruginous; middle tibiæ and the tarsi reddish.

Wings cinereous hyaline; with a large median reddish-brown band extending from the origin of the third vein to opposite the posterior cross-vein and back to the fifth vein, forming very wide clouds on the veins; a narrow cloud of the same color usually present behind the anal cell, the apical fifth of the wing brown, this color extending very broadly in the apical cell toward the median dark area. The median cloud extends only about half-way across the submarginal cell.

Abdomen opaque brownish or reddish brown; second to fourth segment each with a large, basal shining triangle on either side, those on the second segment longitudinally placed, the others transverse; immediately behind the spots on the second segment is a large, semi-circular chalky white pollinose spot. Venter gray pollinose.

FEMALE.—Differs in having the triangles on the third and fourth abdominal segments white pollinose, eye-stalks shorter and the face usually more reddish.

TYPES.—Holotype, male Cameroon, West Africa (Thaxter No. 2718); allotype, female, Cameroon, (Thaxter No. 2717). Paratypes: male, Mayumbe, Gauda Buku, August 4 (A. Collart), in the Musée du Congo Belge; male and two females, Ngomo, Congo, February 2, 1927 (J. Bequaert); female, Cameroon (Conradt), in Deutsches Entomologisches Museum; ninety-two males and sixty-five females, Cameroon.

This series includes a few teneral specimens. These have the thorax castaneous or ferruginous with the mesonotal pollen unusually thin and at first glance would seem to represent a different species. However, the excellent series enables me to definitely associate them with the others. I find, too, that there is a slight variation in the density of the pollen on the sides of the mesonotum in this species, some of them therefore appearing more shining than is usual.

Diasemopsis conjuncta, new species

This species is closely related to *nebulosa,* new species, but the broadly connected brown markings on the wing will at once separate it. Length, 5.25 to 7.5 mm. Width of head: male, 4 to 7.5 mm.; female, 4 to 6 mm.

MALE.—Head brown, thinly brownish pollinose, the upper surface of the eye-stalks ferruginous. Front with a rather strong median carina and with a conspicuous groove toward either side. Eye-stalks slender, the strong bristle arising from a low but conspicuous tubercle; postocular bristle arising from a low tubercle. Antennæ reddish, the second segment partly and the upper border of the third broadly brown; arista brown. Face perpendicular on lower two-thirds, the oral margin slightly produced. Proboscis and palpi reddish yellow. Hair short and very sparse.

Thorax black, brown pollinose, the middle of the pleura very broadly gray; collar shining black. Scutellar spines brown, a little paler apically.

Legs reddish yellow; anterior tibiæ brown; posterior tibiæ a little darkened. Anterior femora not greatly enlarged, the bristles on the apical fourth weak; apices of posterior four femora usually broadly brownish.

Wings cinereous hyaline with brown markings. Apical fifth of the wing brown, very broadly connected along third vein with the median brown area which extends from the posterior cross-vein to inside the posterior cross-vein, does not reach forward more than half-way from the third toward the second vein and is broadly separated from the posterior border of the wing except along the fifth vein. Halteres pale yellow.

Abdomen brown, brown and white pollinose. Second segment at the base with a large, subrectangular shining spot which is produced inward from its anterior half, the shining spots separated by white pollen, the apex of the segment narrowly subshining, obscurely whitish pollinose. Third segment whitish pollinose on the basal sixth, toward the sides more widely shining white pollinose. Fourth segment with wider basal whitish band than the third, the following segments inclined to be shining reddish brown.

TYPES. Holotype, male, Cameroon, West Africa (Thaxter No. 2304); allotype, female, Cameroon. Paratypes; Cameroon (Conradt), in Deutsches Entomologisches Museum; twenty-five males and twenty females, Cameroon.

Diasemopsis hirsuta, new species

An unusually hairy species with extensively brown wings. Length, 6.5 mm.; width of head, 6 mm.

MALE. Head brown, with brown pollen and rather abdundant black hair. Front with a strong median carina and a broad, convex longitudinal ridge on either side. Eye-stalks with the bristle long, arising from a slight tubercle, the postocular bristle long and fine. Antennæ reddish, dark above, the arista brown. Face rather strongly concave, most prominent near its middle, perpendicular below, the oral margin not projecting. Palpi and proboscis brownish red.

Thorax black, moderately brown pollinose, the sternum with cinereous tinge; collar shining black. Hair more abundant than usual; notopleural bristle long, but fine. Scutellar spines reddish, long, the fine apical setæ as long as the spines.

Coxæ, trochanters, broad bases of the femora and all the tarsi, reddish yellow; femora brownish red; tibiæ reddish brown. Femora with long hair, the anterior pair moderately swollen and without distinct bristles apically.

Wings with slight brownish tinge, brown on more than the apical half except in the marginal cell, darker along the veins. Halteres brownish red.

Abdomen brown, brown pollinose, the incisures of the first to fifth abdominal segments faintly and narrowly cinereous; pollen on the very broad sides of the abdomen of a somewhat paler brown color.

FEMALE. Differs only sexually.

TYPES. -Holotype, male, Cameroon, West Africa; allotype, female, Cameroon. Paratypes: female, Mayumbe, Kikionga, Congo, July 24, 1926 (A. Collart), in Musée du Congo Belge; two males, Cameroon.

Diasemopsis æthiopica Rondani

Diopsis æthiopica Rondani, 1873, Ann. Mus. Civ. Genova, IV, p. 289.

Diasemopsis æthiopica Rondani, 1875, Ann. Mus. Civ. Genova, VII, p. 442.

Diasemopsis varians Eggers, 1916, Sci. Res. Zool. Exp. Brit. E. Afr., I, No. 6, pp. 12, 17. (f).

Diasemopsis veliventris Hendel, 1923, Wien. Ent. Zeitg., XL, p. 41.

Diasemopsis elegantula Brunetti, 1926, Rev. Zool. Afr., XIV, p. 83.

A variable species in the female sex, the abdomen often largely reddish, but readily recognized by the very small median bristle on the eye-stalks. Length, 5.5. to 6.5 mm.; width of head, 5.6 to 7.5 mm.

Female.—Head reddish, the face more or less, and the front and eye-stalks, brown; pollen whitish and conspicuous on the face, brownish on the front and eye-stalks, although there is a stripe of cinereous pollen between the base of the antennæ and the eyes. Front with a broad, very gently convex ridge in front of the ocellar triangle. Bristle of the eye-stalk minute; postocular bristle moderately strong. Antennæ reddish, darker above; arista brown. Face convex, gently concave above the oral margin, the anterior oral margin not produced. Hair short and fine, moderately abundant. Palpi and proboscis brownish.

Thorax black, the dorsum brown pollinose; prothorax and pleura cinereous pollinose; collar with a very small, transverse, shining black spot on either side in front or with a rather narrow lateral stripe. Scutellar spines rather short, the apical setæ as long as the spines.

Coxæ, trochanters, tarsi, anterior femora and basal third to half of the posterior four femora reddish yellow, the femora reddish brown apically or even brown; tibiæ reddish brown to brown, the basal tarsal segments brownish. Anterior femora strongly swollen.

Wings cinereous hyaline, the apex narrowly and diffusely brownish; across the middle with a slightly darkened area, but this is not always evident.

Abdomen opaque, black, the disc of the third segment usually with a reddish tinge, sometimes bright reddish, the second and fourth segments sometimes similarly colored; pollen blackish, brown, white and dark reddish. First segment white pollinose except at the apex, the second white pollinose on the sub-basal third and on large posterior triangles, the remainder opaque black, brown or reddish. Third segment with large, subtriangular whitish spots on either side at the base and with the apex narrowly whitish, the apical fascia usually more or less broadly interrrupted in the middle, the remainder of the segment often reddish or at least with reddish tinge, sometimes wholly dull black. Fourth segment with a pair of rather narrowly separated whitish spots occupying more than the basal half of the segment at the sides, but narrowed inwardly, and the apex, white pollinose, the remainder usually dull black, but sometimes reddish. Fifth segment with very much smaller, triangular basal spots and the extreme tip whitish, the disc black to obscurely reddish. Sixth segment dull brownish.

Male.—Abdomen rarely reddish on the fourth segment, otherwise like the female except that it is a little more slender and has longer eye-stalks.

This species was originally described from Erytrea and is the type of the genus. The original description is very good and the species is easily recognizable from it. There are very few *Diasemopsis* with the setæ on the scutellar spines as long as the spines and it seems strange that the species should not have been identified previously. In Brunetti's unfinished manuscript of the Diopsidæ the species was placed in the section with armed oral margin, which seems very strange since Rondani mentioned no oral spines. Brunetti also failed to recognize *varians* Eggers when he described *elegantula* in 1926, since he obviously relied too much upon the illustrations, as may be determined by his redescription of *silvatica* Eggers as *apicenotata*. Egger's figures do not show all the details contained in the descriptions and there is scarcely a trace of the brown spot on the apex of the third vein in *silvatica*, although it is actually very conspicuous and was described by Eggers.

For a long time I have considered *æthiopica* and *varians* to be distinct, basing the separation on the length of the eye-stalks, but I find that the difference in length is more apparent than real since there seems to be a tendency for very small individuals to have relatively shorter eye-stalks.

My specimens of *æthiopica*, numbering more than sixty, are from eastern Congo, upper Congo region, Liberia, Cameroon, Nigeria, and South Africa.

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NEW NEARCTIC COLLEMBOLA[1]

By Harlow B. Mills

Since Packard, in 1873, described a number of springtails which were collected in Texas by Belfrage, the collembolan fauna of this large region has been untouched. A number of his names have fallen into synonymic discard, but it was with considerable interest that collecting was carried on during the fall and winter of 1930 in the vicinity of College Station, Texas, to see which of his species might be rediscovered. Belfrage's material was collected at Waco, about ninety miles north of College Station, and the fauna of the two localities should not differ greatly. Only one of Packard's species has been taken thus far, *Drepanocyrtus bipunctatus* (Packard), a fine large chocolate-brown form which was very abundant throughout the fall.

During the course of these collections four new species were taken, and they, together with two new species from Iowa and one from Louisiana, comprise this paper. Two species of Isotomidæ and five of Entomobryidæ are represented, namely:

Proisotoma bayouensis, new species
Folsomia prima, new species
Entomobrya guthriei, new species.
Entomobrya pseudoperpulchra, new species
Entomobrya sabulicola, new species.
Drepanocyrtus reinhardi, new species.
Lepidocyrtus folsomi, new species

Cotypes of these species have been placed in The American Museum of Natural History, New York City.

The writer is deeply indebted to Dr. J. W. Folsom of Tallulah, Louisiana, who has read the manuscript of this paper for the identification of material, the use of rare literature, and for the most valuable aid which he has received in all of his systematic endeavors.

Proisotoma bayouensis, new species

Light to dark indigo blue; gray to black to the unaided eye. Pigment broken by white spots, various in size, mostly rounded. Intersegmental regions unpigmented, appearing as narrow white bands. Both the spots and the bands are more evident in darker individuals. Antennæ, legs, and furcula blue. Eyes (Fig. 1), eight on each

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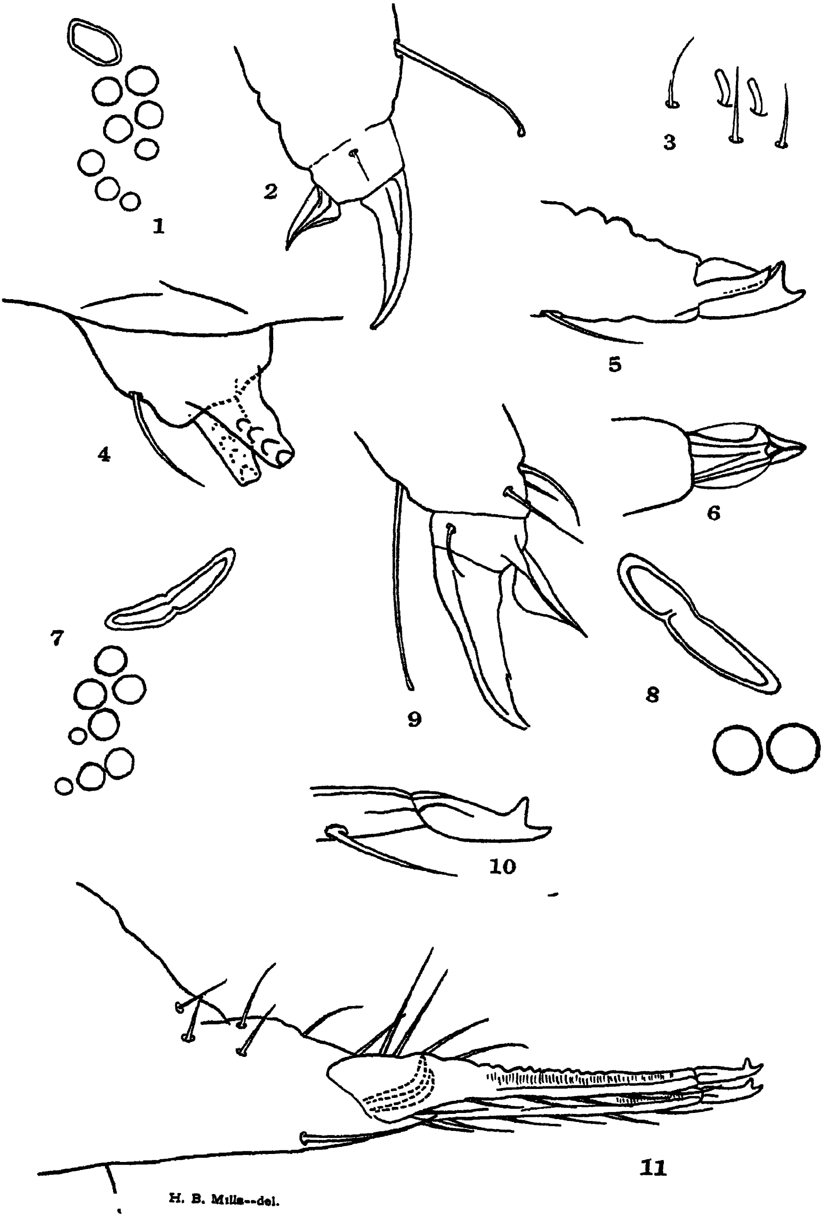
[1] Contribution No. 23, Department of Entomology, Texas Agricultural and Mechanical College.



Figs. 1 to 6. *Proisotoma bayouensis.* 1, Eyes, left side; 2, left hind foot; 3, right antennal organ; 4, left of tenaculum; 5, left mucro; 6, dorsal view of right mucro.

Figs. 7 to 11. *Folsomia prima.* 7, Eyes, right side; 8, left postantennal organ· 9, right hind foot; 10, left mucro; 11, left view of furcula.

side of the head; the two inner proximal ones in each patch smaller than the rest. Postantennal organ (Fig. 1) suboval; twice as long as the width of an adjacent eye. Antennæ and head subequal in length. Antennal segments telescopic; of the ratio 5:7:6:13 or 17:29:25:51, the last segment stout, elliptical. Sense organ of third antennal segment (Fig. 3) with a pair of basally bent sense clubs. Olfactory hairs present on the fourth segment but not greatly differing from the other antennal setæ. Prothorax relatively little reduced, pigmented dorsally; the other segments slightly imbricate. Tibiotarsus occasionally with a distal subsegment. Unguis (Fig. 2) curving, rather slender, without lateral or inner teeth. Unguiculus extending half as far as the unguis, broad basally, acuminate, with two inner basal lamellæ. A single tenent hair present, usually slightly curved at the tip. Genital and anal segment not ankylosed. Fourth abdominal segment considerably longer than the third (as 11:7). Furcula appended apparently to the fifth abdominal segment, reaching to the ventral tube, tapering but slightly distally. Proportions of manubrium to dens to mucro about as 83:71:15; manubrium thus a little longer than the dentes; dorsally with short, stiff bristles and ventrally with one pair (rarely with two pairs) of ventrolateral subapical bristles which are inserted closer to the sides of the manubrium than to each other. Dentes with short, stiff bristles dorsally and on the apical half ventrally; dorsally with from twelve to fifteen very irregular semicircular transverse folds. Mucro (Figs. 5, 6) short, stout, about two-thirds the length of a hind unguis, tridentate, bilamellate; apical tooth slightly curving, anteapical tooth larger and erect, third tooth lateral, nearly superimposed on the second tooth from a lateral view. The inner lamella connects the tip of the anteapical tooth with the mucronal base, and the outer lamella extends from the tip of the lateral tooth to the mucronal base. Rami of tenaculum quadridentate; corpus with one strong anterior seta. Clothing of sparse, sohrt, reclinate setæ. Erect sensory hairs were seen only on the fifth abdominal segment. Length, 0.8 mm.

The posterior margins of the mesonotum, metanotum, and first three abdominal segments are often irregular in outline across the mid-dorsal line.

This species was taken beneath moist boards at the edge of a bayou at Tallulah, Louisiana, July 31 and August 1, 1930.

Folsomia prima, new species

Bluish green with pale spots scattered throughout head and body pigment. Pigment absent on anterior borders of segments from the metanotum to the fourth abdominal segment inclusive, antennæ blue throughout. Legs weakly pigmented. Manubrium pigmented lightly. Dentes colorless. Eyes (Fig. 7) eight on each side on elongate eye-patches; the two inner proximal eyes on each side reduced. Postantennal organ elongate, about six times as long as wide, with a notch near the middle of both the anterior and posterior borders (Fig. 8). Antennæ subequal to the head, the first segment two-thirds the second, which is subequal to the third; the fourth segment twice the length of the third. Sense organ of third antennal segment with two elongate sense clubs and three guard setæ. The three last abdominal segments ankylosed. Unguis (Fig. 9) slightly curving distally with two lateral teeth and occasionally a single minute inner tooth slightly beyond the middle. Unguiculus extending two-thirds as far as the unguis, with an inner lamella which is roundly dilated basally. One, occasionally two feebly-knobbed tenent hairs (which are subequal in length to the unguis) present on each tibiotarsus. Furcula short, reaching just to, or slightly beyond the posterior margin of the second abdominal segment. Manubrium and dentes subequal or the dentes slightly the longer. Manubrium with erect, dorsal setæ; naked ventrally but for two, strong subapical setæ. Dentes (Fig. 11) smooth distally, with irregular dorsal crenulations beginning about one-third its length from the apex. Each dens bears basally several obliquely inserted setæ, one of which is long and suberect. There are also from five to seven ventral dental setæ. Mucro (Fig. 10) about three-fifths the length of the hind unguis, bidentate, the apical tooth almost straight and the anteapical tooth erect. Rami of tenaculum quadridentate; corpus without setæ, but two strong setæ are present on the mid-ventral line just anterior to the corpus. Body clothing of short reclinate setæ and erect, simple, sensory hairs. Length,1 mm.

This slender species was taken beneath bark with *Isotoma cinerea* Nicolet, at Ames, Iowa, February 21, 23 and March 31, 1930. It does not appear to be abundant.

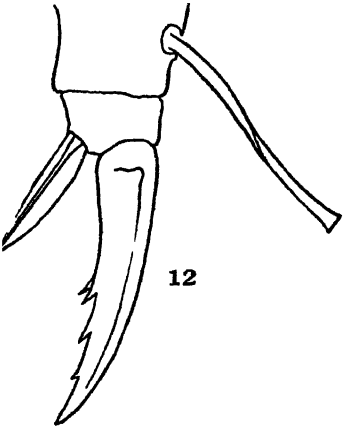
Entomobrya guthriei, new species

General cast light yellow. Body color white to yellow, pigmented with minute purple or rusty-brown flecks which are absent along the sutures of the body segments and very weak along the median-dorsal line. Vertex lightly spotted. Some pigmentation around the eye-spots. A rather indefinite band extends from the anterior inner corner of each eye-spot forward and inward, meeting in a large, elongate-oval pigmented area; the spots of which sometimes coalesce along the anterior border to form an irregular, dark spot. Pronotum colorless. Mesonotum lightly speckled, the pigment darkening laterally and fading on the posterior margin. Metanotum also darkening laterally and free of pigment posteriorly. First abdominal segment lightly pigmented through the center. Second segment colorless on the anterior and posterior borders. Third segment smoothly colored, the pigment extending ventrolaterally onto the paratergite of the fourth segment. Fourth segment colorless or nearly so on the anterior half and very lightly pigmented on the posterior half. Fifth and sixth segments practically colorless. First antennal segment with considerable purple, second segment colorless, third and fourth segments darkening evenly toward the tip. Legs colorless but for some pigment on the precoxal segments and in the darker specimens on the apices of the femora. Manubrium with a slightly purple cast; dentes colorless. Eyes eight on each side (Fig. 13), the two anterior in each eye-patch considerably larger than the other six which are subequal. Antennæ half again as long as the head, segments of the proportions 5:9:7:13. Fourth abdominal segment about four times the length of the third segment dorsally. Unguis (Fig. 12) rather straight, curving slightly distally, with three pairs of extra large teeth on the inner margin. First pair about half-way from the base and not quite opposite, the hind tooth being the more proximal. Unguiculus rather narrowly lanceolate, extending just beyond the basal pair of teeth on the unguis. Tenent hair with a triangular distal swelling; nearly as long as the unguis. Furcula reaching the ventral tube. Dentes longer than the manubrium (as 35:45) with strong dorsal crenulations which stop nearly four times the length of the mucro from the tip of the dens (Fig. 14), minute crenulations continuing to the base of the mucro. Mucrones (Fig. 14) of the usual entomobryan type, but distinctive in that the anteapical tooth points slightly forward. Clothing of many small reclinate hairs and long clavate, fringed setæ which are most abundant on the meso- and metanotum and which extend onto the first two antennal segments. Length, 1.5 mm.

This species is named for Prof. J. E. Guthrie of the Department of Zoölogy and Entomology, Iowa State College, through whom the writer became interested in this group. The specimens were taken from decaying wood in which termites had been living. The termites, together with the wood, and without doubt the springtails, came to the Department of Zoölogy and Entomology of the above-named college from Berkeley, California.

Entomobrya pseudoperpulchra, new species

Color deep yellow to orange with purple pigment becoming blackish where dense. Head and legs sometimes nearly white. First antennal segment purple at the tip, second segment with the distal third colored, third segment with the distal half colored, fourth segment all purple, but lighter at the base. Eye-spots connected through the antennal bases by an indefinite line which forms an irregular median spot on the front. Poorly defined lines extend posteriorly also from the eye-spots to the prothorax which bears dorsal pigment. Mesothorax bordered laterally and anteriorly with more dense pigment which is light along the midline. Irregularly placed purple spots are found occasionally on the mesothorax, metathorax, and the first abdominal segment. In dark specimens the entire antennæ may be purple except the base of the first segment. A few specimens were taken in which the precoxal pieces of the first two pairs of legs, the posterior margin of the mesothorax, the metathorax, and all of the first abdominal segment except a narrow band along the anterior and one along the posterior margin were colored, in addition to the typical body pigmentation described above. Furcula light, sometimes nearly colorless. Eyes eight on each side (Fig. 15), the two inner proximal eyes on each side reduced in size. Antennæ more than twice the length of the head, the first two segments subcylindrical, the third subclavate, and the fourth elongate-elliptical. Fourth abdominal segment slightly more than three times the length of the third along the dorsal midline. Unguis (Fig. 17) straight, curving but slightly at the tip, with a pair of inner teeth midway between the base and the tip, and a second but smaller pair between the basal pair and the tip. An outer tooth is present nearly opposite the basal inner pair. Unguiculus slender, pointed, two-thirds the length of the unguis. Tenent hair gently curving, with a distal triangular swelling; as long as, or somewhat longer than, the unguis. Furcula reaching the ventral tube. Manubrium about two-thirds the length of the dentes, with long pinnate hairs dorsally. Dentes strongly corrugated dorsally, the folds ending about two and one-half times the length of the mucro from the tip of the dens. The pinnate hairs of the manubrium extend onto the base of the dens. Mucrones (Fig. 16) small, with the usual apical tooth, anteapical tooth, and basal spine. Each of the two rami of the tenaculum bears four teeth; the corpus bears a single large anterior seta which curves strongly at the tip. Clothing of small, reclinate hairs which are longer on the fifth and sixth abdominal segments; also larger, fringed, clavate hairs which are most abundant on the head, meso- and metathorax.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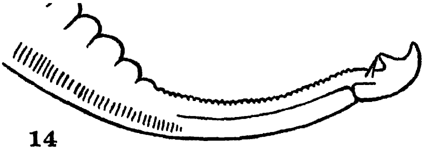
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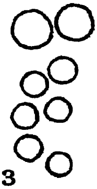
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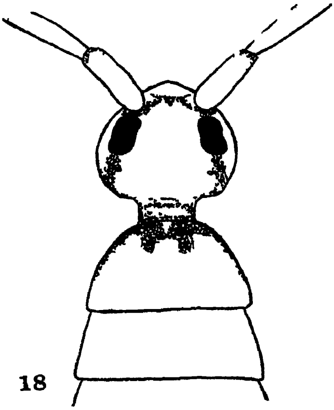
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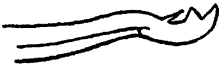
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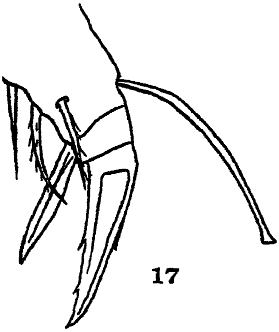
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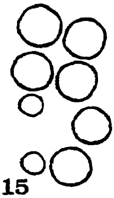
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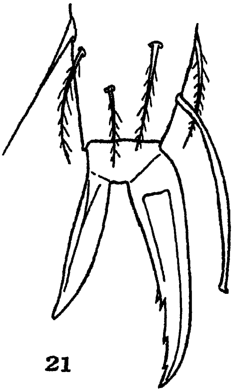
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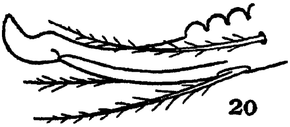
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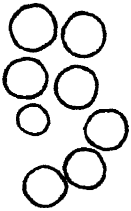
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Figs. 12 to 14. *Entomobrya guthriei.* 12, Left hind foot; 13, left eyes; 14, left mucro
Figs. 15 to 18. *Entomobrya pseudoperpulchra.* 15, Right eyes; 16, left mucro; 17, right hind foot; 18, color pattern of head and thorax.

Figs. 19 to 21. *Entomobrya sabulicola.* 19, Right eyes; 20, right mucro; 21, right hind foot.

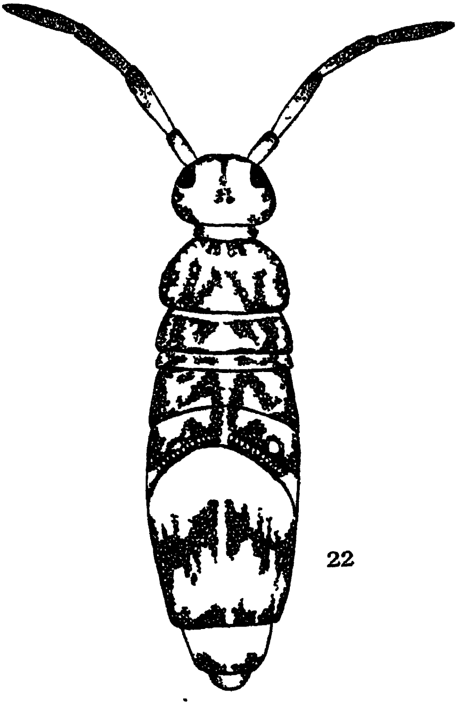
Bothriotricha were seen on the fourth abdominal segment. Comparatively long curving hairs occur on the first three antennal segments and are replaced on the fourth by many short strongly curved hairs. Length, 0.9 mm.

Nymphs of this species are nearly transparent and the dark contents of the digestive tract can readily be seen through the body wall. This species was taken solitarily or in small numbers beneath boards at College Station, Texas, throughout October and November, 1930.

As its name denotes, this species resembles *Entomobrya perpulchra* Packard (Fifth Annual Report of the Trustees of the Peabody Academy of Science, p. 38, 1873). So far as his description goes, the species in hand agrees fairly well with it, and it was at first taken for Packard's species. The writer is indebted to Dr. J. W. Folsom for tracings of drawings of *E. perpulchra* from Packard's types in the Museum of Comparative Zoölogy, which show the mucro to be falcate in that species, a condition entirely different from that in the species here described as new.

Entomobrya (Drepanura) sabulicola, new species

Body color gray, sometimes yellowish, with blue pigment. Color pattern intricate and somewhat variable. Figure 22 represents a dark specimen. From a lateral view the body seems to be marked with two indistinct lines on each side; the lower ones connected around the anterior margin of the mesonotum and extending more or less obscurely to the fifth abdominal segment, and the upper ones from the middle of the mesonotum to and including the third segment. Antennæ dark at the tip, shading to light at the base, each segment with a dense portion distally. Eyes connected over the front by a black line which often extends back on the midline over the vertex. A dark line connects the eye patches with the prothorax laterally, and in dark specimens this line covers most of the genæ. Prothorax colored laterally. Mesothorax margined anteriorly and laterally; with a variable pattern on the disk, sometimes a single line, sometimes a fork, and sometimes a loop on each side. Metathorax with irregular blotches of pigment. First abdominal segment but lightly colored dorsally, with two patches on each side. Second abdominal segment with the two lateral patches and irregular markings dorsally. The lateral patches are usually connected on the third segment, with the dorsum rather well covered with pigment. A row of light spots often extends around the posterior margin. Paratergite of fourth segment usually colored. Fourth segment with two bands, a broad one across the middle and a narrow posterior one. Fifth segment pigmented posteriorly. Sixth segment lightly colored laterally. A median colorless line divides all of the dorsal pigment. Legs colorless save the coxæ and precoxæ in densely pigmented specimens. Furcula practically colorless. Eyes eight (Fig. 19) on each side; the third eye from the front on the inner row of each patch slightly reduced. Head three-fifths the length of the antennæ. Of one specimen the ratio of the antennal segments was 8:18:15:20. Fourth abdominal segment about four times the length of the third dorsally. Unguis (Fig. 21) straight, rather slender, curving slightly at the tip; with a pair of teeth near the middle that are not opposite, the distal tooth being on the posterior lamella, and one (sometimes two) small teeth between the first pair and the tip



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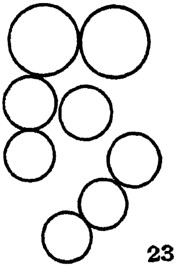

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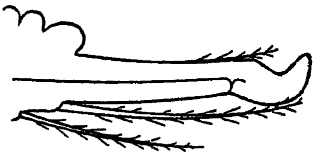

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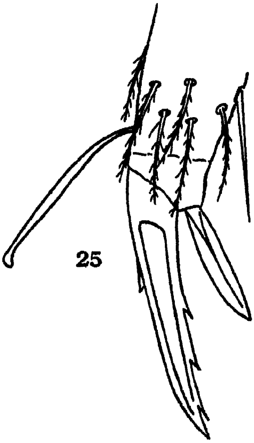

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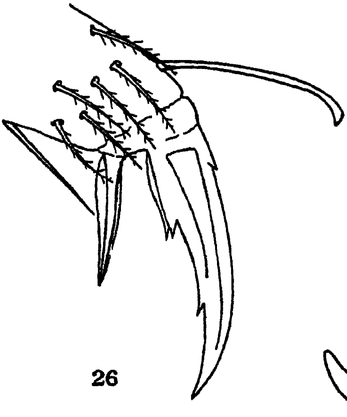

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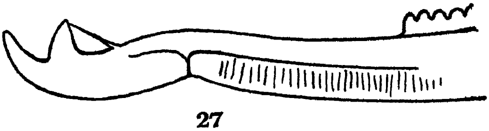

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Fig. 22. *Entomobrya sabulicola*, dorsal view.

Figs. 23 to 25. *Drepanocyrtus reinhardi*. 23, Right eyes; 24, left mucro; 25, left middle foot.

Figs. 26 and 27. *Lepidocyrtus folsomi*. 26, Left hind foot; 27, right mucro.

No lateral teeth present. Unguiculus broadly lanceolate, two-thirds the length of the unguis. Tenent hair long and slender, subequal to the unguis. Furcula reaching the ventral tube. Manubrium slightly more than two-thirds the dentes. Dens strongly corrugated dorsally, the corrugations ending about twice the length of the mucro from the tip of the dens. Mucro (Fig. 20) falcate with no basal spine. The two rami of the tenaculum quadridentate with a single anterior bristle on the corpus which curves back strongly at the tip. Body covered densely with close-lying hairs which are very long laterally, and the usual fringed clavate hairs which are most abundant on the thorax. Bothriotricha were seen as follows: one pair on the second abdominal segment, one pair on the third abdominal segment, and two pairs on the fourth abdominal segment. Manubrium and dentes quite hairy. Long fringed hairs occur on the first three abdominal segments, those on the first segment are often clavate. Ventral tube with a number of long curving anterior hairs and short spines surrounding the tip. Length, 1.5 mm.

This species has been taken only on sandy soil where it occurs abundantly. Its gray color so perfectly camouflages it against the sand that it can seldom be seen, except when it is moving. It was taken at Bryan, Texas, throughout October and November.

Drepanocyrtus reinhardi, new species

Color entirely silvery white but for the intensely black eye-spots and the antennæ which fade from light purple at the tip to white at the base. Eyes (Fig. 23) eight on each side, the anterior pair on each side somewhat larger than the others which are subequal. Antennæ long, a little less than three times the length of the head, segments of the proportions 11:18:19:26. Fourth abdominal segment about four times the length of the third on the dorsal midline. Unguis (Fig. 25) straight, with three inner pairs of teeth, the first two pairs fairly large and sharp, the third or distal pair acicular. An external pair is also present about a third of the distance from the base. Unguiculus extending to a point midway between the first and second pairs of teeth of the unguis, lanceolate. Tenent hair nearly straight, a little shorter than the unguis, enlarged but slightly at the tip. Furcula reaching the ventral tube. Manubrium five-eighths the length of the dentes. Dentes coarsely corrugated dorsally, the corrugations ending about one and one-half times the length of the mucro from the tip of the dens. Mucro (Fig. 24) falcate, without a basal spine. Body covered with large obovate scales which bear fine striations. The first three antennal segments bear rather long reclinate hairs and longer, nearly erect, sensory setæ; the fourth segment with short recurving hairs of about equal length. Head with many fringed, feebly clavate hairs. A dense collar of them occurs on the anterior border of the mesonotum, and numbers of them on the mesonotal disk. They also occur in fewer numbers on the posterior halves of the metanotum and the first three abdominal segments. A number of fine short hairs are found at the base of these large fringed hairs on the metanotum and first three abdominal segments. The fourth abdominal segment bears a number of the large fringed hairs rather evenly over the dorsum. Some of these hairs are not at all distally clavate, and are exceptionally long (one and one-half times the length of the third abdominal segment). The large hairs become more numerous and are rather strongly curved on the fifth and sixth abdominal segments.

Manubrium and dentes with many pinnate hairs dorsally and scales ventrally. Pinnate hairs from the dentes extend to the tip of the mucro. Legs with many closelying hairs, and longer sensory hairs; a very long sensory hair at the base of each tibiotarsus on the external surface. Ventral tube with many long, curving anterior bristles and two types of short hairs near the tip, strongly curving hairs (which resemble the olfactory hairs of the antennæ of the Isotomidæ and Poduridæ), and a slender, erect series. Rami of the tenaculum quadridentate, the single anterior bristle of the corpus bending strongly at the tip, and exceeding the tips of the rami. Bothriotricha were seen on the fourth abdominal segment. Length, 3 mm.

This fine large species is noteworthy in the presence of the exceptionally long sensory setæ which are borne basally and externally on the tibiotarsi. These hairs on the first pair of legs are somewhat shorter than on the second and third pairs, but are still quite long. It is named for H. J. Reinhard of the Texas Agricultural Experiment Station, who procured all of the specimens. Every one was taken beneath a desk light in the Experiment Station building where it was found hopping about, seemingly attracted to the light. Specimens in vials were found to be positively phototropic. The writer is indebted to Dr. J. W. Folsom for the drawing of the eyes of this species.

Lepidocyrtus folsomi, new species

Color entirely white, the scales lending a silvery appearance. Eyes absent. Antennæ nearly twice the length of the head; the segments varying in length but about as 10:20:20:35; the first three segments subcylindrical and the fourth elongate-elliptical. Mesonotum massive, hiding the pronotum dorsally. Fourth abdominal segment about four times the length of the third dorsally. Unguis (Fig. 26) curving apically, with a pair of baso-lateral outer teeth, a pair of large basal inner teeth, and a single inner tooth between the basal pair and the tip. The basal pair are not exactly opposite, the one on the anterior lamella being slightly more distal. Unguiculus narrowly lanceolate, acute at the tip, extending nearly to the single distal tooth of the unguis. Tenent hair slender, feebly knobbed, shorter than the unguis. Furcula reaching the ventral tube. Manubrium and dens subequal or the manubrium slightly the shorter; scaled ventrally and bearing rather numerous heavy hairs dorsally. Dentes tapering evenly to the tip; very uniformly but finely corrugated dorsally, the corrugations ending slightly more than the length of the mucro from the dental apex; bearing ventral scales and a row of long pinnate hairs on each side of each dens. Both the ventral scales and lateral hairs of the apices of the dentes exceed the tips of the mucrones. Mucrones large (Fig. 27), with the usual apical and anteapical teeth and the basal spine, which attains and sometimes surpasses the tip of the anteapical tooth. Rami of tenaculum quadridentate, the corpus bearing a single anterior seta which curves strongly at the tip, and does not extend beyond the tips of the rami. Head and body densely clothed with large oval to obovate scales which bear fine striations. A row of sharp, forward pointing bristles is borne on the posterior margin of the head. The genæ bear minute spines and larger bristles which become more abundant toward the mouth. The anterior border of the mesonotum bears a dense row of short, clavate, fringed hairs. The rest of the body is sparsely covered with simple or but slightly clavate fringed hairs, which are abundant and strongly clavate on the fifth and sixth abdominal segment. Two pairs of bothriotricha were seen on the fourth abdominal segments. Coxæ with rows of extra long smooth setæ externally. Femora and tibiotarsi densely clothed with hairs. Scales mostly round or oval. Maximum length, 2. mm.

This species was taken beneath boards at College Station, Texas, October 20, and at Bryan, Texas, October 31. It resembles *Lepidocyrtus violentus* Folsom from which it is easily distinguished by the claws, the comparatively longer fourth abdominal segment, and the larger size. It is very different from the above species in its actions, for when it is disturbed it exhibits none of the nervousness of *L. violentus.*

AMERICAN MUSEUM NOVITATES

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A YOUNG RAINBOW TROUT (*SALMO IRIDEUS*) WITH A "HORN" (THE ACHENE OF *BIDENS CERNUA*) ON ITS HEAD

By E. W. Gudger

In August, 1928, I visited the trout hatchery just under Balsam Gap, six miles west of my home, Waynesville, North Carolina. The superintendent, Mr. Frank J. Rieger, finding that I was interested in fishes, showed me a bottle containing a considerable number of teratological trout embryos and then brought out as the prize of his collection the little trout which forms the subject of this article. Seeing my very great interest in this remarkable specimen, he kindly presented it to me. It is a young rainbow trout (*Salmo irideus*) about three months old and 33 mm. long, hatched and raised to its present size under the personal care of Mr. Rieger. Its death had been caused, so far as he could tell, by the fungus growth on the head at the base of the "horn." As to the cause of the development of the "horn," he could only suggest that it was possibly due to the improper handling of the water supply. He remarked that he had several other specimens of similar development, but not quite so perfect, together with other abnormalities, in the same lot of developing embryos with this little fish. When he changed the water supply his fish-cultural operations became much more successful.

My own ideas tallied exactly with his conclusions. This looked like a perfectly good horn, of chitinous or fibroid material, growing out of the middle of the forehead of the little fish, just at the level of the front edge of the eyes. There was, indeed, down the front edge of the snout a fine sliver of some material, but I thought it a part of the horn and paid no attention to it. I knew that hard cutaneous horns, abnormal growths, are found on the heads of various animals including that of the highest, *Homo sapiens*, and I presumed that this was some such object. The presence of fungus (probably *Achlya* or *Saprolegnia*) around the base of the horn was explained thus:—the little fish, swimming about, would strike the horn against the side of the tank, irritate and probably break the skin at its base, and thus offer an entrance for the spores of water molds which, upon development, would form the mycelium that could be plainly seen.

This all seemed very plausible and very sound until some months later I had an artist make a drawing (Fig. 1) 3.2 times the natural size of the fish, by aid of a low-powered binocular dissecting microscope. The specimen had been viewed through this binocular before, but nothing had been found to controvert the structures described in the above paragraph. However, in order to clearly see the details of the horn, the fish was now put under the low power of a compound microscope. Then it was noticed that the horn, when seen in lateral view, had two roots, each a continuation of a ridge or fluting on the upper part of the horn, and that the anterior root had retrorse spines on it. These structures at once called for a different interpretation and it seemed that it might be some kind of seed which had become stuck fast to the fish's head. Just here the artist had to leave this work to take up some other illustrating, my own time was demanded for other work, so the little fish was put away, and it is only very recently that I have found the time to resume its study.

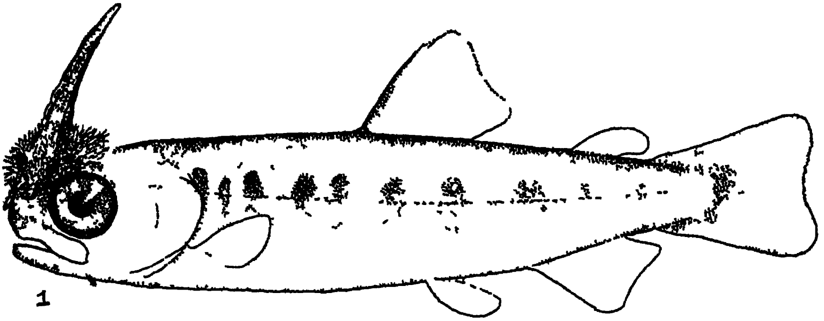
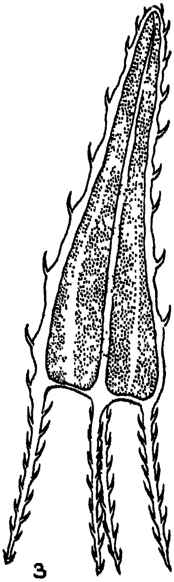


Fig. 1. The little fish with the "horn," enlarged about 3.2 times (33 to 107 mm.).

Later on, however, the specimen was seen by Prof. C. D. LaRue of the University of Michigan, while visiting the department of fishes. He suggested that it was a fruit of the "sticktight," *Bidens*. I have recently submitted the troutlet with its horn to Dr. J. K. Small, head curator of the New York Botanical Garden, for examination. He kindly identified the horn as the fruit of the "sticktight" or "bur marigold," *Bidens cernua*, sometimes called the "beggar tick." This plant, which is akin to the so-called "Spanish needle," is a member of the family Compositæ. The compound flower is somewhat flat, like that of a daisy, and when the fruits or achenes are ripe they form a dense flat cluster, in which the pointed ends or bases are below and the broad tips with two to four awns project into the air. The awns, about half as long as the achene, are beset with many retrorse hooks, and the attachment of these to the hair of an animal or the clothing of man justify the common name "sticktight."



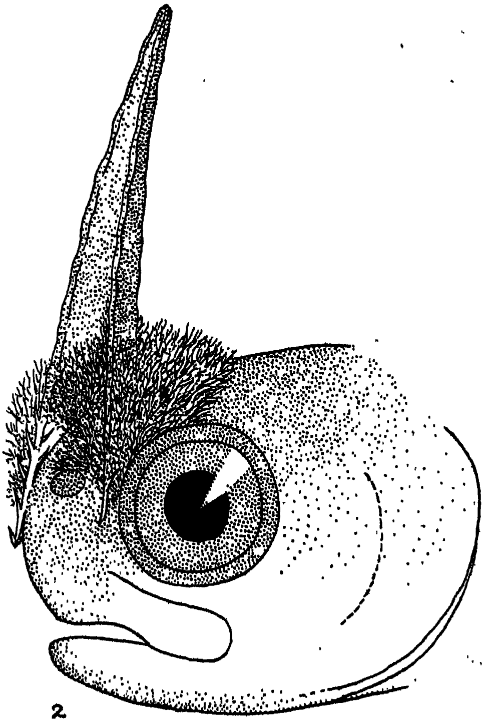


Fig. 2. The head and the "horn" enlarged about 7.5 times to show the details. Note the barbs on the anterior "root" of the horn.

Fig. 3. An achene of the "sticktight" enlarged about 7.5 times to show the details of its structure.

This is now not hard to understand. The tip of the horn is the base of the achene, the base of the horn is the blunt tip of the achene, and the sliver down the front of the head of the troutlet is one of the awns. Figure 2 shows the head of the little trout with the attached awn magnified 7.5 times. Two awns with their retrorse hooks are plainly visible.

Dr. Small gave me several achenes, and from these I picked out one having as nearly as possible the same size and shape as that attached to the young trout. Figure 3 is a drawing of this to the same scale and in the same position as that on the head of the little fish. Here is the four-sided achene with ribs at the angles, each beset with barbs. Each rib is continued as an awn, beset with two rows of retrorse hooks. The body of the achene attached to the little fish has no hooks, but has roughened places on the ribs. It would seem that the hooks have been broken or rubbed off this by the fish striking the horn against the sides of the hatching trough.

The attachment of the "horn" to this trout is easy to explain. The achene either was blown by a breeze through an open door or window into the hatchery and fell in the trough where the little fish was, or was carried in with the water supply, passing readily through an ordinary fine-meshed screen. The troutlet, swimming around in the tank, no doubt struck its head against the tip of the seed pod and the recurved hooks fastened themselves in the tender skin. Through the wounds thus made the spores of water molds penetrated into the tissues, sprouted and formed a mycelium which enmeshed the base of the horn and held it tightly in place. Less understandable is how the achene could have come to rest standing almost squarely in the median vertical plane of the body of the fish, with the rear awn, if present, set in the skin of the head squarely in the median line. What is more probable is that this achene had only three awns—two lateral ones and the one in front, the hinder one either having been broken off or having failed to develop. With only three awns present it is more understandable how this achene came to be saddled on the snout of the baby fish.

There is in the literature of fishes no account of any such structure on a fish, so far as I know, but there is an account of "sticktights" as fish destroyers. O. Lorenz in 1880 published a short article[1] on this subject. This is such an unusual matter that it seems well to reproduce the major part of it. He notes that the seed pods of this plant bore through the clothing of pedestrians and cause extreme irritation. After stating that it grows in damp soil, in pits, on shores and right in the water, he continues as follows:

> *Bidens cernua*, var. *radiata* grows in the water. Its seeds are provided with three bristling beards, entirely covered with barbs from top to bottom. It is these barbs

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[1] "Ein Fischverderber (*Bidens cernua*) aus dem Pflanzenreich." Oesterreich.-Ungarn. Fischerei-Zeitung, Wien, 1880, III, pp. 27–28.

> which are injurious to pond fishes, namely those fishes which feed on a vegetable diet, thus including the whole family of the Cyprinidæ. . . .
>
> . . . Through the breathing movements of the fishes the seed pods are disturbed so that they desert their radiate container and, vampire-like, sink their bearded points into the mouth and food openings of the fishes. The result of this is very unfortunate for professional pisciculturists. When I saw the fishes to whose mouth and nostril openings clung, leech-like, these fish pests which I had never before encountered, I captured as many of them as I could, and when I was sure of their identity (i.e., that of the fish pests), I pulled away the pod. In so doing a small piece of epidermis was always sacrificed to the barb. However, to ease my conscience, I observed that all the fishes on whom I had completed this operation swam about happily in the water, while all the others perished.
>
> As soon as these fish destroyers push into the smelling, feeding, and breathing mechanisms of the fishes, an inflammation of the epidermis sets in and the wounded place is swollen with blood under the skin. After a few days, fungus-covered sores develop and, since the fish from now on is unable to get any nourishment, hunger is added to the pain caused by the wound and the two together rob the fish of its life. In the light of this knowledge, the extermination of *Bidens cernua* is to be recommended to every fish culturist or pond owner.

It will be of interest to add that Dr. Frank E. Lutz, of the American Museum, who keeps and breeds considerable numbers of aquarium fishes in his home at Ramsey, New Jersey, has made similar observations. In order that the water in his aquaria may be properly oxygenated, he brings in and plants in them water weeds from various ponds in the vicinity. These weeds are gathered from the edges of the ponds where "sticktights" grow, and hence before being put in the aquaria are well washed in order to rid them of achenes and other unwanted things. Nevertheless, some of the achenes of the sticktights often get into the aquaria, and the fishes are not infrequently found with these attached to their heads, as noted by Lorenz. It is necessary to remove the achenes by the aid of forceps, but if they are firmly anchored to the fish this procedure may cause considerable laceration, likely to be followed by fungus infection, and often by the death of the fish.

This added observation of Dr. Lutz' would indicate that these sticktights probably do more injury to fishes than is realized, and that their presence in our pond waters should be a matter of interest and concern to aquarists and fish farmers generally.

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THE SHOVEL-TUSKERS, AMEBELODONTINÆ, OF CENTRAL ASIA[1]

By H. F. Osborn[2] and W. Granger

Borissiak's most welcome description (April 6, 1928, pp. 105–120) of *Platybelodon danovi*, discovered in the summer of 1927 in the Chokrak beds (Middle Miocene?—*fide* Bor.) of the Kuban region, North Caucasus, anticipated by one year the Andrews-Granger discovery (July 28, 1928) of *Platybelodon grangeri* in the Pliocene **Tung Gur** horizon of Mongolia; in the same description Borissiak (*op. cit.*, p. 119) proposed the subfamily name Platybelodontinæ, signifying 'flat-tuskers.'

Both of these Asiatic discoveries were partly anticipated by Barbour's finding (April 4, 1927) of *Amebelodon fricki* in southwestern Nebraska, to which he applied (June, 1927) the family name Amebelodontidæ,[3] signifying the 'shovel-tuskers.' *Amebelodon* has extremely long and relatively narrow shovel-tusks, while *Platybelodon* has relatively short and extremely broad shovel-tusks; these animals consequently represent *two entirely distinct generic phyla.*

PLATYBELODON DANOVI BORISSIAK: GENERIC AND SPECIFIC CHARACTERS

Following the admirable papers (1928, 1929) of Dr. A. Borissiak, we may here give a brief synopsis of the characters of the genotypic species *Platybelodon danovi* Borissiak, of the Caucasus, also a characterization of the new form *Platybelodon grangeri* of eastern Mongolia.

The genotype, *Platybelodon danovi*, consists of the anterior portion of a cranium and nearly complete jaws (probably belonging to one individual), in the Leningrad Museum, having the following measurements, as compared with *P. grangeri* (Amer. Mus. 26200, type; Amer. Mus. 26202, paratype):

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 108.

[2] This is the author's twenty-third communication on the evolution and classification of the Proboscidea since 1918, and the thirty-third in his total list of papers on the Proboscidea since 1907. See the author's chronologic and classified Bibliography to the end of the year 1929, namely, "Fifty-two Years of Research," pp. 3–54, 74–124.

[3] Modified by Barbour (1929. 1, p, 138) to Amebelodontinæ.

	Platybelodon danovi Type	*Platybelodon grangeri* Type Amer. Mus. 26200
MANDIBULAR MEASUREMENTS		
Mandible:		
Length, condyle to tip of incisor	?1240 mm.	1530e mm.
condyle to tip of median symphysis	1102e	1340c
Symphysis:		
Length, to tip of incisors	700	880
to symphysial border	518	670
Breadth (maximum)	245	380–388
Breadth (minimum)	130	165
Mandibular ramus:		
Breadth, maximum (thickness)	90	106
Depth, maximum (height)	120	178
DENTAL MEASUREMENTS		
Inferior incisive tusks:		
Breadth (width)	110	166
Thickness	15–30	ext. 25–33 med.
Third inferior molar M_3		
Length	168–170	
Breadth (width)	67	
Height	30–25	
Second superior molar, M^2		
Length	98–100	
Breadth (width)	65	
Third superior molar, M^3		
Length	130–133	
Breadth (width)	65	
Height	41	

These comparative measurements show that all the dimensions, mandibular and dental, of *Platybelodon grangeri*, including the lower molars, exceed those of *P. danovi* in the ratio of 5 to 4, this ratio being established by eight measurements common to both species, namely, *P. grangeri* 5249 mm., *P. danovi* 4145 mm. This average increment of *P. grangeri* over *P. danovi* of 5 to 4, however, is exceeded in the anterior part of the symphysis and in the incisors of *P. grangeri;* the ratio in this pre-mandibular region is as 8 to 5, or, from the three measurements in common, as 873 to 575; the pre-mandibular numerical ratio rises as follows:

MAXIMUM BREADTH OF ROSTRUM	*P. danovi*	*P. grangeri*
Symphysis	245	380
Single flattened incisor	110	166
Combined incisors at tip	220	327
	575	873

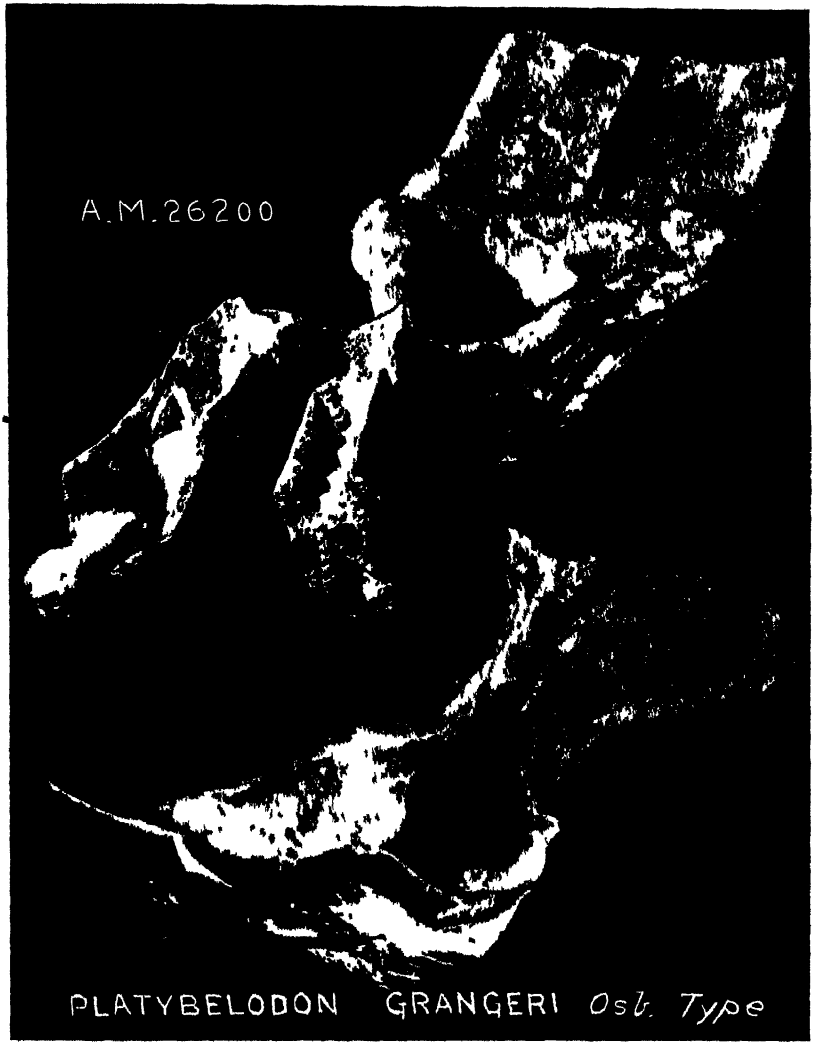


Fig. 1. Type mandible of *Platybelodon grangeri* Osb (Amer. Mus. 26200), in oblique superior and anterior aspects. About one-eighth natural size.

Observe that the inferior incisors are accidentally separated; in the natural condition of the jaw (Fig. 3 A1) they are closely approximated, as indicated by dotted lines.

This establishes as a clearly distinctive specific character of *Platybelodon grangeri* its more progressive and highly specialized functional flat-tusk or platybelodont anterior region, namely, *the flat- or shovel-tusk region evolves most rapidly since it has become vitally important in the struggle for existence.*

Thus clearly establishing the progressive specific characters of *Platybelodon grangeri*, we may pass to a summary of all the extraordinary characters of this new species, a knowledge of which has been gained by a comparison of the twenty more or less complete specimens collected by Andrews and Granger in the **Tung Gur**, a relatively thin horizon, about 100+ feet in thickness, exposed in a radius of approximately ten miles. These type and referred materials apparently do not differ greatly in geologic age or specific progression; the variations in size lie rather in differences of age as between the referred immature cranium (Amer. Mus. 26201), and jaw of an estimated condylar-symphysial length of 980 mm., as compared with 1340e mm. in the type.

CRANIAL MEASUREMENTS	*Platybelodon danovi* Type	*Platybelodon grangeri* Type Amer. Mus. 26200
Fragment preserved:		
Length, glenoid to tip of superior incisors	746 mm.	
occipital condyle to tip of premaxillaries (est.)	819	1120 mm.
Maxillo-premaxillæ:		
Length	310	
Breadth (maximum)	180	
Incisive tusk:		
Transverse breadth (thickness)	40	

GENO-SPECIFIC CHARACTERS OF P. DANOVI.—Maxillo-premaxillæ, flattened and broadened. Two superior grinding teeth functional in adult dentition, orbit above M^3; M^2 three crested, with typical bunolophodont intermediate conules, as in *Phiomia* M^3 four crested, bunolophodont, with lophs and conelets of *Phiomia* type. Superior incisive tusks small, rounded, diameter 40 mm. *Mandible* with low and massive rami, greatly prolonged anteriorly and upcurved towards extremity of incisors; symphysis greatly elongated, gradually expanding from narrowest portion (130 mm.) to broadest terminal portion (245 mm.); inferior double tusks with flattened, slightly concave surface above, greatest breadth 110 mm., thickness along midline 30 mm., along thinner outer line 25 mm., taken anteriorly 15–20 mm., converging at tip, slightly separated at emergence from jaws; enamel absent on upper surface, with irregular longitudinal grooves, protected below by enamel longitudinally striated (1929, p. 22).

The above synopsis from Borissiak's admirable text and figures (Figs. 1–4, Pls. III–V) demonstrates the complete generic distinction of

COMPARATIVE MANDIBULAR AND DENTAL MEASUREMENTS OF TYPE, PARATYPE, AND JUVENILE PLATYBELODON GRANGERI

	Amer. Mus. 26200 Type	Amer. Mus. 26202 Adult Paratype	Amer. Mus. 26201 Juvenile
Mandibular Measurements			
Total length	1340e = 4 ft. 4¾ in.	1015 + mm. = 3 ft. 4 in.	980 mm. = 3 ft. 2½ in.
Symphysis:			
Length to end of alveolus	655e = 2 1½		415 = 1 4¼
Breadth (maximum)	388 = 1 3¼		229 = 9
Breadth (minimum)	165 = 6½		122 = 4¾
Ramus:			
Depth below M 2	150 = 5⅞	129 = 5$\frac{1}{16}$	106 + = 4⅛
Breadth opposite M 2	111 = 4⅜	91 = 3½ +	101 = 4

Dental Measurements

	l.M_2	l.M_3	r.M_2	r.M_3	l.M_1	l.M_2	r.M_2	r.M_3
Anteroposterior	109	205	100	192	92e	123	125	?
Transverse	63	68	61	69	51	58	55	55+
Height	?	69	?	70	?	63	60	59e

Platybelodon Borissiak (1928, 1929) from *Amebelodon* Barbour (1927); it also shows that the easterly Mongolian form discovered by Andrews and Granger in July, 1928, belongs to an entirely distinct species, to which Osborn in 1929 assigned the name '*Amebelodon grangeri*,' in honor of the discoverer of the type and referred specimens, and which may now be redescribed as *Platybelodon grangeri*.

Platybelodon grangeri Osborn, 1929

Collection, 1928. Tairum Nor Basin, Mongolia. **Tung Gur** Pliocene.

TYPE.—Amer. Mus. 26200 (Field No. 812). Lower jaw, back part weathered out; grinding teeth missing. A large fully adult individual.

PARATYPE.—Amer. Mus. 26202 (Field Nos. 791, 792). Middle portion of right and left adult lower jaws, containing finely preserved second and third inferior molars of both sides, M_2, M_3. All measurements agree precisely with those of the type, consequently used in the restoration.

TYPE DESCRIPTION.—(Osborn, 1929.769, pp. 13–16): "A new species of mastodont named *Amebelodon grangeri*, a descendant of the primitive long-jawed mastodont (*Phiomia*) of northern Africa. Adapted to uprooting bulbous plants, it frequented the shallow lake waters of ancient Gobi. . . . This unique type of mastodont was first described by Prof. Erwin H. Barbour from a fossil jaw which he found in western Nebraska and to which he applied the highly appropriate generic name *Amebelodon* (derived from two Greek words signifying 'shovel' and 'end-tooth'). The Gobi discovery, which may be named *Amebelodon grangeri* confirms in the most surprising manner the adaptation so aptly named by Professor Barbour, and it demonstrates, as in the case of all the other quadrupeds, that the Gobi climate and environment were even more favorable than that of the Nebraska plains in Pliocene time, because in the Gobi shovel-tusker the dimensions are nearly double those of the Nebraska shovel-tusker."

SPECIFIC CHARACTERS.—Type exceeding *Platybelodon danovi* in size, mandibular dimensions in ratio of 5 to 4; in pre-mandibular dimensions in ratio of 8 to 5. Anterior portion of mandible greatly broadened; second inferior incisors correspondingly broadened, flattened, and relatively shortened; post-mandibular proportions as in *P. danovi*.

MATERIALS.—Besides the type and paratype fully adult jaws there are four individuals represented by referred crania and jaws, several individuals represented by isolated fragments of inferior grinding teeth, six individuals represented by inferior incisive tusks, two individuals by superior tusks; five individuals represented by unassociated foot bones, which enable us to estimate approximately the height and bodily proportions of *Platybelodon grangeri*. In detail the materials are as follows:

REFERRED CRANIA AND JAWS

Amer. Mus. 26201 (Field No. 793). Juvenile cranium and lower jaws, vertically crushed, containing superior incisive tusks, r. and l. I^2, and M^1, M^2, also M_1, M_2, M_3; inferior flattened tusks wanting.

Amer. Mus. 26203 (Field No. 791A). Left lower jaw fragment, containing second and third inferior molars, M_2, M_3. Adult, exceeding type and paratype in size.

Amer. Mus. 26204 (Field No. 794). Fragment of left lower jaw with perfect l.M_2, slightly exceeding type in size.
Amer. Mus. 26210 (Field No. 806). Fragment of ?M^3.
Amer. Mus. 26243 (Field Nos. 795 A, B, C, D, E). Fragments of five grinding teeth.
Amer. Mus. 26212 (Field No. 806 D, E, F, G). Jaw fragment and portions of inferior grinding teeth.

INFERIOR INCISIVE TUSKS:
TYPE (Amer. Mus. 26200). A perfect pair (see Figs. 1 and 3).
Amer. Mus. 26205 (Field No. 795). Fractured portion of an r.I_2 (sectioned).
Amer. Mus. 26206 (Field No. 795). Outer fractured portion of r.I_2.
Amer. Mus. 26207 (Field No. 795). Median portion of r I_2 (sectioned). See figure 2.
Amer. Mus. 26208 (Field No. 795). Left incisor fragment (sectioned).
Amer. Mus. 26209. Anterior fragment of an l.I_2, showing sharpened edge.
Amer. Mus. 26211 (Field No. 806). Median portion of an l.I_2, displaying dentine.

SUPERIOR INCISIVE TUSKS:
Amer. Mus. 26201 (Field No. 793). Right and left rounded tusks, juvenile, female.
Amer. Mus. 26212 (Field No. 806A). Right superior tusk, r.I^2.
Amer. Mus. 26212 (Field No. 806B). Core, male superior tusk.

FOOT BONES:
Amer. Mus. 26212 (Field No. 806F). Unassociated posterior and anterior foot bones.

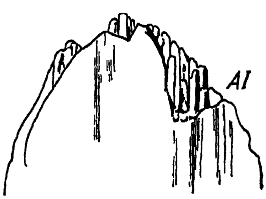
SUPERIOR INCISORS. The superior tusk-like incisors are relatively short and slightly out-turned; subcylindrical to cylindrical in section; slightly downturned, worn sharply at extremities (806A). In the juvenile specimen (Amer. Mus. 26201), a female tusk not fully emerged presents at a point about 200 mm. from the tip a transverse measurement of 47 mm., and a vertical measurement of 48 mm. Whereas a supposed male tusk (806A) presents at a point 204 mm. from the tip a transverse measurement of 47 mm., and a vertical measurement of 56 mm. The core of a still larger male tusk (806B) presents a transverse measurement of 63 mm., and a vertical measurement of 70 mm., taken at the same distance.

INFERIOR INCISORS AND DENTINAL TUBULES

In the type (Fig. 3A--Amer. Mus. 26200) the lower incisors, on excavation, were rightly estimated at 14 in. (360 mm.) in total length, of which the exposed portion measures exactly 8¾ in. (225 mm.); width 6½ in. (166 mm.); median thickness at point of exposure 1¼ in. (33 mm.); thickness along outer border 1 in. (25 mm.).

Portions of five more or less fractured lower incisors reveal a very new and important character, also observed in the *Amebelodon fricki* of Barbour, namely, the presence of very numerous and closely compacted dentinal tubules within the inferior incisive tusks. Figure 2A1, representing a partly fractured crown of Amer. Mus. 26207, shows a portion of this tubular area and a mass of these dentinal tubules; in transsection these tubules are seen in Fig. 2A, each of which has a small lumen. This discovery led to the examination of a portion of a left lower incisor of *Amebelodon* from Texas (Fig. 2B—Colo. Mus. 1319), in which similar dentinal tubules are displayed, although the fossilization is much less clear and distinct.

The dentinal tubules are somewhat smaller and more closely compacted in *Platybelodon* (Fig. 2A) and more numerous, namely, of an estimated total of 250 separate tubules. In *Amebelodon* (Fig. 2B) they are larger, and much less numerous, namely, of an estimated total of 100–150. The function of these tubules is probably to strengthen the inferior tusks and to resist the results of abrasion of the beveled edges, as shown in figure 3 A1. The microscopic structure will be given further study.



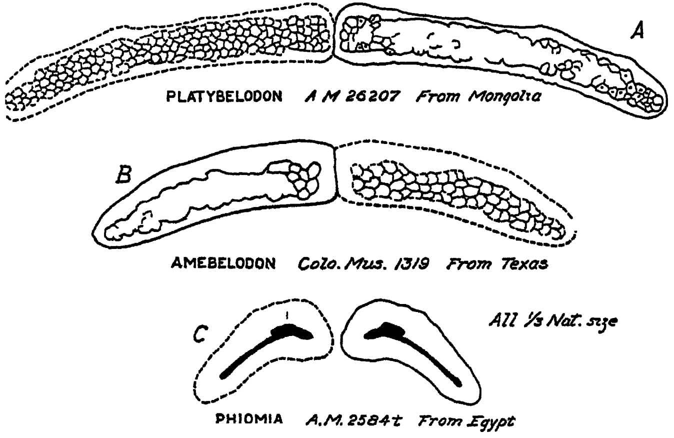

A
PLATYBELODON A M 26207 From Mongolia
B
AMEBELODON Colo. Mus. 1319 From Texas
C
All ⅓ Nat. size
PHIOMIA A.M. 2584t From Egypt

Fig. 2. COMPARISON OF PLATYBELODON, AMEBELODON, AND PHIOMIA INCISORS
All one-third natural size

A, Diagrammatic transsection of the right lower second incisor of *Platybelodon grangeri* (Amer. Mus. 26207). The left lower incisor is restored.

A1, Superior aspect of the right lower second incisor of same specimen (Amer. Mus. 26207) showing the partly exposed dentinal tubules.

B, Transsection of the left lower second incisor of *Amebelodon fricki* (?) ref. (Colo. Mus. 1319) from the Pliocene of Texas. The right lower incisor is restored.

C, Section of the right lower second incisor of *Phiomia osborni* (Amer. Mus. 2584t) from the Oligocene of the Fayûm, Egypt, exhibiting open dental pulp cavity. The left lower incisor is restored.

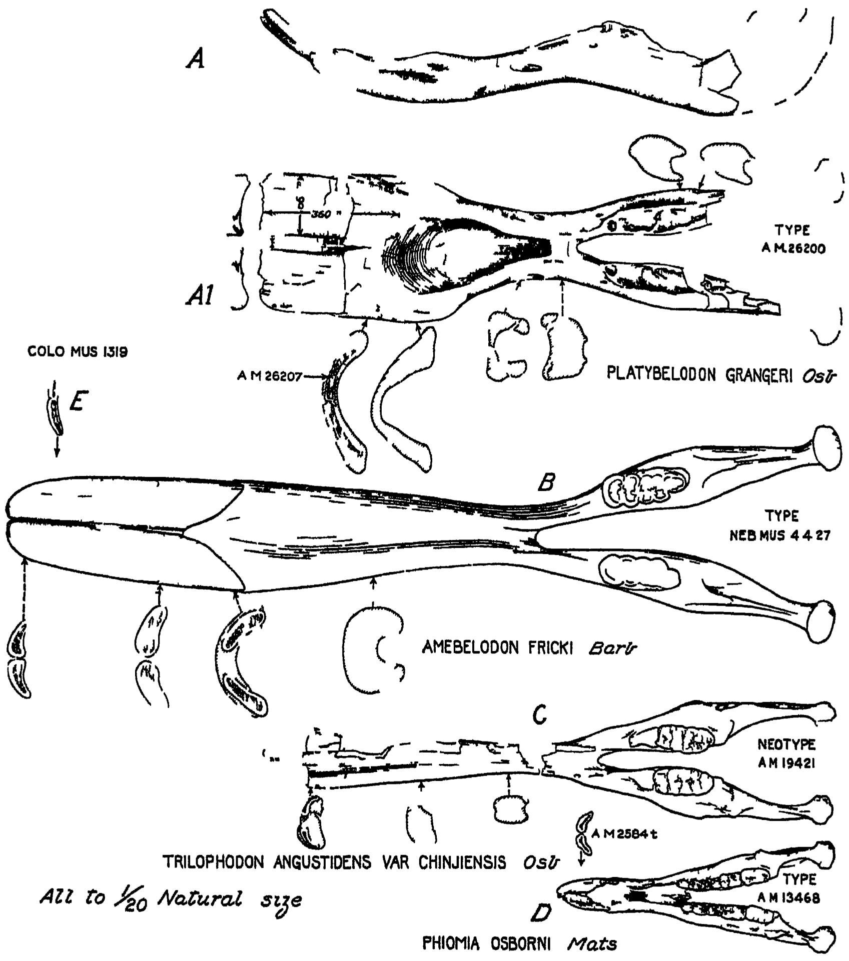


Fig 3 Comparison of Platybelodon, Amebelodon, Trilophodon and Phiomia
All one-twentieth natural size

A, *Platybelodon grangeri* type (Amer Mus 26200) Lateral aspect

A1, The same, superior aspect, with sections of the rostrum and mandible at six points indicated

B, *Amebelodon fricki* Barb type (Neb Mus 4–4 27), with *theoretic* section of the lower incisors and jaw at four points indicated

E, Actual section of terminal region of incisive tusk of *Amebelodon fricki* ref. (Colo Mus. 1319)

C, *Trilophodon angustidens* var *chinjiensis* Pilg -Osb Neotype (Amer. Mus 19421), Chinji horizon, Middle to Upper Miocene, with sections of hollow lower incisors at three points indicated

D, *Phiomia osborni* Mats. type (Amer Mus 13468), Lower Oligocene Fluviomarine of the Fayûm, Egypt

The presence of these dentinal tubules appears to unite *Platybelodon* and *Amebelodon* into a single subfamily, the AMEBELODONTINÆ of Barbour, 1929, embracing two phyla:

Amebelodon Barb., with relatively long and slender rostrum and incisors (Fig. 3B).

Platybelodon Bor., with short and extremely broadened rostrum and incisors (Fig. 3A, A1).

The comparative diagram (Fig. 3 A–D) of *Platybelodon*, *Amebelodon*, *Trilophodon*, and *Phiomia* seems to demonstrate that *Trilophodon* and *Phiomia* should remain in the subfamily Longirostrinæ, as they resemble each other in the presence of large hollow pulp cavities in the lower incisor teeth, as shown in the sections (Fig. 3 C, D). This is a somewhat surprising result, because in the superior aspect of the jaw, *Phiomia*, *Trilophodon*, and *Amebelodon* appear to form a natural ascending evolutionary series. The *transsections* of the incisive teeth prove that in its hollow incisors *Phiomia* resembles *Trilophodon*, while it differs widely from *Amebelodon* and *Platybelodon*.

Finally, this remarkable comparative diagram (Fig. 3) demonstrates that the postsymphysial portions of the jaw and grinding teeth undergo little progressive evolution except in size; it is the anterior symphysial and rostral region of the shovel-tuskers or Amebelodontinæ that undergo such an extraordinary specialization, while the grinding teeth remain substantially the same.

The unusual adaptations in the anterior portion of the jaw do not prevent the theoretic derivation of all the longirostrines from varied specific stages of *Phiomia*, as suggested by Osborn in the years 1921–1925.

In 1921 Osborn (1921.526, p. 331) wrote as follows: "*Phiomia* is certainly ancestral to the Bunomastodontidæ only, in fact, barely separable generically from *Trilophodon angustidens*, the typical longirostrine." In 1922 (Osborn, 1922.566, p. 454): "6. Longirostrinæ, typical long-jawed bunomastodonts arising in North Africa (*Phiomia*), spreading all over southern Europe, Asia, and North America." In 1925 (Osborn, 1925.637, p. 5): "V. THE LONG-JAWED MASTODONTS, OR LONGIROSTRINES, springing from the long-jawed *Phiomia* of the Egyptian Oligocene and becoming the *Trilophodon* of Europe, migrating through Europe and Asia in the Miocene and spreading over Nebraska, Kansas, South Dakota, and Colorado in Pliocene time."

TYPE DESCRIPTION OF THE NEW GENUS AND SPECIES *TORYNOBELODON LOOMISI* BARBOUR, 1929

After the manuscript of the above number of Novitates was written and approved, and actually sent to the press for publication (March 6, 1931), the present authors received (March 9, 1931) Prof. Erwin H. Barbour's most interesting Bulletin No. 16, of December, 1929, which will be fully abstracted and illustrated in Osborn's forthcoming Proboscidea Monograph. Unfortunately the original copies of Barbour's Bulletin 16 (issued in December, 1929) miscarried and the first copy received came in response to a letter from the senior author to Professor Barbour, dated February 25, 1931, to which Professor Barbour most kindly replied, immediately mailing another copy of Bulletin 16.

We therefore desire to give Professor Barbour the fullest credit for prior description of the remarkable dentinal tubules of which the tusks of *Torynobelodon loomisi* are composed.

BIBLIOGRAPHY

BARBOUR, ERWIN H.

1927.1. Preliminary Notice of a New Proboscidean Amebelodon fricki, gen. et sp. nov. Bull. Neb. State Mus. 13, Vol. I, June, pp 131-134, text figs. 89-91.

1929.1. The Mandibular Tusks of Amebelodon fricki. Bull. Neb. State Mus. 14, Vol. I, December, pp. 135-138, text fig. 92.

1929.2. The Mandible of Amebelodon fricki. Bull. Neb. State Mus. 15, Vol. I, December, pp. 139-146, text figs. 93-97.

1929.3. Torynobelodon loomisi gen. et sp. nov. Bull. Neb. State Mus. 16, Vol. I, December, pp. 147-153, text figs. 98-100.

1930.1. Amebelodon sinclairi sp. nov. Bull. Neb. State Mus. 17, Vol. I, January, pp. 155 158, text fig. 101.

BORISSIAK, A.

1928. On a new Mastodon from the Chokrak beds (Middle Miocene) of the Kuban region, *Platybelodon Danovi* n. gen. n. sp. Ann. Soc. Paléont. Russie, Tom. VII, for the year 1927, pp. 105-120, Pl. VIII, text figs. 1 and 2. April 6, 1928.

1929.1. On a New Direction in the Adaptive Radiation of Mastodonts. Palæobiologica, Band II, pp. 19-33, Taf. III-V, text figs. 1-4.

OSBORN, HENRY F.

1921.526. Evolution, Phylogeny, and Classification of the Mastodontoidea. Bull. Geol. Soc. Amer., Vol. XXXII, pp. 327-332 (dated September 1, 1921, issued October 5, 1921).

1922.566. Migrations and Affinities of the Fossil Proboscideans of Eurasia, North and South America, and Africa. Amer. Nat., Vol. LVI, No. 646, Sept.-Oct., pp. 448-455, 1 text fig.

1925.637. The Elephants and Mastodonts Arrive in America. Nat. Hist., Vol. XXV, No. 1, Jan.–Feb., pp. 3–23, frontispiece and 16 text figs.

1929.769. The Revival of Central Asiatic Life. Nat. Hist., Vol. XXIX, No. 1, Jan.–Feb., pp. 2–16, 3 plates, 12 text figs , 2 maps.

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THE NEST HABITS OF THE DIPLOPTEROUS WASP *POLYBIA OCCIDENTALIS* VARIETY *SCUTELLARIS* (WHITE) AS OBSERVED AT BARRO COLORADO, CANAL ZONE

By Herbert F. Schwarz

The wasps whose activities are recorded in this paper were first observed in the late afternoon of Nov. 8, 1930, on an ornamental shrub near the Laboratory at Barro Colorado Island by Dr. Frank E. Lutz, who directed my attention to them. The observations were terminated on Dec. 4, when I collected the nest and its inmates, with the kind assistance of Mr. E. I. Huntington. During this period of somewhat under a month, there were only a few days when the wasps did not receive at least an inspection, and a number of days out of the total were devoted largely or wholly to their study. I am indebted to Dr. Lutz and to Mr. Huntington for suggestions and other aid in the course of my observations and to Dr. J. Bequaert for his kindness in identifying the wasp.[1]

When first noticed, the wasps were assembled on several contiguous leaves of the shrub and there was as yet no evidence of a nest. Their actual number was not readily ascertainable, but, as no less than 130 wasps were collected from the nest on the final day and as the most mature part of the brood in the nest had at that time not yet pupated, it is a practical certainty that at least 130 wasps were present from the start. The nest was collected at 5:30 in the morning, before activities had begun, and it is my belief that approximately all of the inmates of the nest were secured.[2]

According to Donato, the caretaker of the Laboratory and an unusually keen-eyed observer of nature, the wasps had originally occupied a nest on a nearby shrub. There was indeed such a deserted nest only a few feet distant and this nest in its size as well as in its external and internal architecture, and in the number of its cells, approximated the nest subsequently built by the wasps herein described. I think almost without a doubt that the two nests were the work of the same species and in all probability of the same colony. There had been a raid of army ants on Nov. 8 all over the grounds of the Laboratory and possibly nest No. 1 had been ravaged by the ants and thereupon abandoned by the wasps. There were no evidences of brood in nest No. 1 when I examined it, and many of the cells of the comb were broken, suggesting possible violence.[1]

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[1] What is apparently an important contribution to the life-history of *Polybia occidentalis* var. *scutellaris* was published in 1896 by P. A. Schupp, S. J., in Natur und Offenbarung, XLII, pp. 143–151. The volume in question is, so far as I have been able to ascertain, not available in any public library in the United States. The observations of Schupp were made, I infer, on a South American colony of *scutellaris* that had reached a far greater stage of maturity than the one here described. From citations of Schupp's article in the papers of other authors—especially Wasmann—the habits of the two colonies would seem in some respects at least to be distinct.

[2] Bertoni (p. 120) collected a nest of *Polybia fastidiosuscula* de Saussure by night. The nest was devoid of brood and it was, therefore, inferred that the adults, to the number of 200, were the original founders of the nest (Bertoni, 1912, Museo Nac. de Hist. Natur. de Buenos Aires, (3) XV, pp. 97–146).

Nest No. 2 (the one to which this paper is devoted) was apparently begun on Nov. 9. On that day I noticed an incipient comb about three-quarters of an inch in diameter that had been attached to a twig of the shrub at a level of three or four feet from the ground. On setting out for a tramp on the morning of Nov. 10 I observed that the comb was still exposed and that it had at that time between 30 and 40 cells. On my return from the tramp that evening the nest was again examined. It had during the day been extended laterally and fastened for further support to the under side of two conveniently located leaves. The envelope had then been extended downward somewhat and curved under so as to form a covering below the comb. This under-curved extension was subsequently to be used as the ceiling of a second comb, but on the evening of Nov. 10 it was only about half completed, concealing about half of the cells of comb No. 1, and as yet devoid of cells of its own. Although only from 30 to 40 cells were noted on comb No. 1 on the morning of Nov. 10, there were counted 109 cells on this comb when the nest was opened on Dec. 4

Further notable progress was made on Nov. 11. By 3 P.M. of that day not only had the cover been extended below comb No. 1 so that that comb was now enclosed, except for a nest-entrance 1¾ cm. in width by 9 mm. in height, but on the under side of the cover had been constructed the cells of comb No. 2. There were about 20 cells to a row and it was calculated (πr^2) that comb No. 2 contained about 300 cells. Actual count, made when the nest was opened on Dec. 4, revealed a total of 280 cells. Comb No. 2 was not composed of a flat alignment of cells but instead showed a marked yet symmetrical convexity.

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[1] Brethes cites (p. 34) Dr. Rodriguez Gallego of Mercedes (Uruguay) to the effect that swarms of *scutellaris* that go forth toward the end of summer construct a provisional nest in which to pass the winter and abandon it when the fine season arrives (Brethes, J., 1903, Anales del Museo Nac. de Hist. Nat. de Buenos Aires, (3) II, pp. 15–39). Bertoni, too, states (p. 119) that nests of *scutellaris* up to 4 cm. in diameter occur at the beginning of winter, and that these nests are abandoned before procreation takes place (Bertoni, A. de W., 1912, Anales del Museo Nac. de Hist. Natur. de Buenos Aires, (3) XV, pp. 97–146). The observations at Barro Colorado were made toward the close of the rainy season but I can hardly believe that the abandonment of nest No. 1 is in this instance at least to be explained as a seasonal phenomenon, for the presence of cells seemed distinctly to indicate the expectation of a brood.

On Nov. 12 the wasps proceeded to extend the envelope. By 10 A.M. a slightly sloping roof had been projected on an average about half an inch beyond the circular cluster of cells, reminding me a little of the architecture employed in the houses of the Canal Zone to shield the dwellings from the rain. By 11:30 A.M. the envelope was being built not laterally and outwardly but downwardly and with an inslope, so as ultimately to cover comb No. 2. Building activities were being concentrated on that part of the envelope that was at the opposite extreme from the nest-entrance, the envelope being extended gradually in the direction of the nest-entrance or the fore part of the nest. By 2 P.M. the envelope had been built forward under comb No. 2 and at that stage concealed about one-quarter of the comb.

Fig. 1 -Nest of *Polybia occidentalis* var *scutellaris*, with its stalactite-like ornaments below. The leaf in contact with the nest and slightly above the portal was a menace, tending to shed gathered rain drops on the nest. The wasps subsequently removed the greater part of this leaf. Photograph by Dr. F. E. Lutz.

The following day (Nov. 13) building operations were pursued actively throughout the morning but slackened as the day progressed and became virtually stagnant after 1:30 P.M. At the close of the operations on Nov. 13 the envelope was nearing completion. The outer entrance-hole (as distinguished from the inner one that gave access only to comb No. 1) was at this time about an inch in width by a half an inch in height as contrasted with its final size, 11 mm. in width by 8 mm. in height.[1]

On the following morning (Nov. 14) the building activities were of a somewhat scattered character. Some of the wasps continued the task of reducing the size of the nest-entrance while here and there a wasp started to lay the foundations on the under side of the envelope of what was ultimately to develop into a series of six haphazardly placed, long, narrow stalactite-like ridges, measuring respectively 16 mm., 11 mm., 8 mm., 8 mm., 8 mm., 7 mm. These pendant ridges were architectural features lacking on the abandoned nest No. 1 and seemed the product of an exuberant desire to labor rather than a useful addition to the structure.

Building activities did not cease on Nov. 14. In fact, they continued almost right up to the time the nest was collected on Dec. 4. The last actual observed instance was on Dec. 2, but, judging from appearances, I believe that the wasps must have been at work also on the morning of Dec. 3. On neither the afternoon of Dec. 2 nor that of Dec. 3 was construction undertaken. As a general rule, indeed, the colony was more industrious in the mornings than in the afternoons, when activities usually grew dull or were suspended.

After Nov. 14 the wasps would occasionally lengthen the stalactites or narrow the nest-entrance; but their more serious efforts were applied to strengthening the supports of the nest. On Nov. 16 it was noted that a leaf, ordinarily concealed from view at the back of the nest, had been attached as a support. It is possible that this was accomplished on Nov. 15. Four other leaves had been employed as supports in the course of constructing the nest. Two of these were on the side remote from the entrance-hole, a third was on the under side of the envelope at the end where the nest-entrance was situated, and a fourth was somewhat back of the nest-entrance, on the upper part, or roof, of the nest. The two leaves on the side remote from the entrance-hole and that on the roof above were not papered over completely, but appeared, when the nest was subsequently opened, as green, window-like spaces framed by masonry. The leaves in these cases were, therefore, used not merely for support but as a substitute for the standard building material.

In its essentials, and ruling out of consideration the stalactite-like additions, the nest as finally collected was substantially constructed in five days (Nov. 9–Nov. 13). It had at that time a width of about 6 cm., a breadth of about 5 cm., and was just under 4 cm. in height. It consisted of two enclosed combs.

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[1] R. von Ihering notes that the entrance-hole may show a great difference in size from nest to nest. He records (p 256) a range of from 7 × 10 mm to 5 × 7 cm. (Ihering, Rudolf von, 1904, Revista do Museu Paulista, VI, pp. 95–309).

Had the wasps been given further opportunity, I think it likely that from time to time other combs would have been added but the relatively frail support from which the nest was hung seemed in this case to set a limit to indefinite expansion, and it is doubtful whether the nest would ever have attained a size comparable with the nest from which the type material of *scutellaris* was derived,[1] namely, 21 inches × 17 inches × 11 inches,[2] or with the even more prodigious nests mentioned by Lucas.[3] One of these, of unrecorded locality, was 72 cm. in length and had a circumference of 1 m., 20 cm.; the other, from the department of Facuarembo, belonging to Uruguay, measured 75 cm. in height and had a width of 45 to 50 cm. The latter nest, according to the natives of the region, was the work of from twenty-five to thirty years![4]

There is another reason, however, for believing that the size of the Panamanian nests may be relatively small. Ducke,[5] in commenting on *Polybia occidentalis* and its varieties, notes that nests in regions remote from the equator are apt to be characterized by larger size. Inversely those relatively near the equator might be expected to be small.

> Without doubt, in regions more remote from the equator, this wasp has acquired the habit of building very large nests, which are more resistant to the effect of winter; this tendency may be observed in the case of several species of American wasps. It would be very interesting to know the nidification of the form previously mentioned from Guiana which has the colors of *scutellaris*: it is probable that under the climatic conditions of this land the nidification is not distinguished in any way from that of *occidentalis* s. str. Nests as extraordinary as those of *scutellaris* from southern Brazil would have difficulty in escaping collectors in a region like French Guiana, which for the vespids is one of the best known regions of the American continent!

It is further to be noted that, astonishingly rapid as construction seemed to be during the first few days, when two combs were completed, there was no expansion of the Barro Colorado nest subsequently. In contrast, H. von Ihering indicates that in Brazil colonies of *scutellaris* erect in two or three weeks nests consisting of from four to five combs,[6] and a nest begun on May 20 that R. von Ihering collected on July 11 had at that time seven combs.[7]

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[1] White, A., 1841, Annals and Mag. Natur. Hist., VII, pp. 322, Pl. iv, figs. 1–7.

[2] White, A., 1843, Annals and Mag. Natur. Hist., XII, pp. 268–270 and 322.

[3] Lucas, H., 1867, Ann. Soc. ent. de France, (4) VII, pp. 365–368; 1885, *op. cit.*, (6) V, p. liv.

[4] Hardly less impressive than these nests is another mentioned by Lucas. The nest in question (from the environment of Montevideo) was 54 cm. in length and 1 m., 35 cm. in circumference. R. von Ihering gives as the maximum size of those nests of *scutellaris* that had come to his attention one measuring 55 cm. by 35 cm. (Ihering, R. von, 1904, Revista do Museu Paulista, VI, pp. 95–309).

[5] Ducke, A., 1910, Ann. Histor.-Natur. Musei Nation. Hungarici, VIII, pp. 449–544.

[6] Ihering, H. von, 1896, Zool. Anzeiger, XIX, pp. 449–453.

[7] Ihering, R. von., 1903, Zool. Anzeiger, XXVII, p. 115.

Even more remarkable than differences of size are, however, differences in the architecture of the nests of *scutellaris*. At first glance the nest from Barro Colorado, with its, for the most part, smooth and unornamented exterior, seems so different from the nest of spiny surface figured by White that one would hesitate to associate the two. Yet both types are the achievement apparently of the same wasp. While in southern Brazil and Argentina the spine-studded type of nest is the prevalent one, in Rio de Janeiro, Minas Geraes, and São Paulo nests devoid of spines predominate.[1] In Puerto Bertoni, Paraguay, and in all the region exclusive of the forest of the Alto Paraná as far as Yaguarasapá the smooth type of nest occurs according to Bertoni (p. 119), whereas six leagues to the interior from Puerto Bertoni the spiny type of architecture begins to manifest itself and this type predominates in the entire region contiguous to the open country.[2]

In addition to these rather striking variations in the architecture of the nest, Ducke indicates (p. 497) that there is also instability in the coloration of the insect: "The most remarkable of all the races of *occidentalis* is *scutellaris* White, entirely black with the scutellum intensely yellow; . . . . in the case of this insect as in the case of its nests all the gradual transitions to the common form of *occidentalis* are observable."[3] Even among the individuals from the single nest observed at Barro Colorado there are many gradations, including, at the one extreme, forms more highly maculated than White described under *scutellaris* and, at the other, almost wholly black individuals (seven in all) devoid of maculations on the scutellum but with a brief stripe on the mandibles and a faint band apically on the petiolate first segment of the abdomen. These melanistic specimens seem to come close to what de Saussure interpreted as *parvula* Fabricius or what du Buysson described as *Polybia occidentalis* var. *diguetana*.[4]

The methods employed in building by the colony at Barro Colorado may now be described. There is, I believe, a division of labor or what approximates a division of labor. Certainly again and again, after keeping close watch of a returning forager as she crawled about the nest distributing her load of pulp among the artisans there assembled, I have seen her finally deliver the last particle, make her toilet, refresh herself, and set forth, probably in search of more material. The laden wasp arrived at the nest with her burden held not merely by her mandibles but enfolded like a bundle by her front pair of legs. Without releasing this hold, she walked about the nest on her middle and hind legs, seeking a worker with whom to share the pulp. Sometimes the entire load was handed over to an accommodating individual, and the foraging wasp was then free to set forth at once. More often, however, the receiving wasp took over only half the burden, holding it in like manner with mandibles and forelegs, and thereupon both wasps moved about over the nest, dividing their respective loads with other wasps, which in turn sought out additional members of the colony with whom to share, until finally the material was fractioned so finely that it could be used for building purposes.[1] These distributions were made most frequently on the top of the nest and in plain view. Sometimes the wasps there assembled were few in numbers, and under such circumstances it now and then happened that two laden individuals rushed up to each other, impelled by the same impulse, only to find that neither was in a position to accept the offering of the other.

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[1] Von Ihering, R., 1904, Revista do Museu Paulista, VI, p. 257, and Ducke, A., 1910, Ann. Histor.-Natur. Musei Nation. Hungarici, VIII, p 497.

[2] Bertoni, A. de W., 1912, Anales del Museo Nac. de Hist. Natur. de Buenos Aires, (3) XV, pp. 97–146.

[3] Ducke, A., 1910, Ann. Histor -Natur. Musei Nation. Hungarici, VIII, pp. 449–544; also 1907, Boletim do Museu Paraense, V, p. 178.

[4] Buysson, R. du, 1905, Bulletin de la Société entomol. de France, 1905, p. 9.

While building material was being distributed by some of the returning foragers, others came back from their field trips with stores of liquid, almost certainly water,[2] which was likewise shared with the artisans, especially those on the roof of the nest. A glistening drop of fluid would suddenly appear between the opened mandibles of a returning wasp and would be imbibed by one of the nest occupants. A second drop would well up from the internal reservoir and would pass to the mouth of another waiting wasp In some instances, just before a forager that had been distributing pulp set forth again on one of her flights, she would stop to take the offered sip of moisture. It may be that these distributions of liquid were made not primarily for purposes of refreshment—although the burning heat on sunny days might have seemed to justify such a conclusion but rather for the lubrication of the building material, insuring its pliability. The newly applied building material was always of darker hue than the old, dried material and gave evidences of being saturated with moisture. I suspect that this saturation was at least in part accomplished by regurgitation of liquid during the process of subdivision.

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[1] Janet (p 63) observed no distribution of building material in the colonies of *Vespa crabro* although food often underwent division among the workers of the nest (Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp 1–140 with 41 figs) Similarly Reaumur (p 177) had previously recorded that foraging individuals of *Vespa crabro* themselves apply to the paper edifice the pulp that they have succeeded in gathering (Reaumur, M. de, 1742, Mémoires pour servir à l'Histoire des Insectes, VI, pp 155–214).

[2] On one occasion (between 8:30 A M and 8 15 A M , Nov 22) I noted a worker visiting a leaf near the nest and lapping up a drop of water that had gathered on it Thereupon the wasp flew back to the nest and shared the liquid with the wasps there assembled.

As in the case of the wasps providing building material so in the case of the water-carriers, I was able to observe repeatedly that after making their distributions they would fly forth from the nest presumably again to forage. It seemed possible that there was something approaching a division of labor not only between foragers and artisans but even between hod-carriers and water-carriers, for I doubt whether the hod-carriers would have partaken of a drop of liquid, as they now and then did, before setting forth on their flights if the object had been merely to bring this liquid back again to the nest. On Dec. 2 I noted that three of the foragers lapped water from a moist leaf before setting forth on what I assumed were further foraging expeditions. Nevertheless, it must not be concluded that the division of labor above mentioned was absolute. The members of the colony had sufficient versatility to assume on occasions other rôles. In one instance a wasp arrived bearing liquid but failed to find at once a recipient. At this point a second wasp arrived with building material, and the wasp that had the drop of moisture took over a part of the other's load.[1]

Nov. 12 was a day of considerable building activity and the record of laden wasps returning to the nest between 12:50 P.M. and 1:50 P.M. of that day is as follows:

	Wasps carrying building material to nest	Wasps bringing liquid to nest
12:50 P.M.—1:05 P.M.	9	7
1:05 P.M.—1:20 P.M.	10	6
1:20 P.M.—1:35 P.M.	10	9
1:35 P.M.—1:50 P.M.	7	8

A fuller record is available for the following day, Nov. 13, likewise a period of marked building activity:

	Wasps carrying building material to nest	Wasps bringing liquid to nest
7:45 A.M.— 8:00 A.M.	13	2
8:00 A.M.— 8:15 A.M.	13	3
8:15 A.M.— 8:30 A.M.	12	2
8:30 A.M.— 8:45 A.M.	14	0
8:45 A.M.— 9:00 A.M.	10	5
9:00 A.M.— 9:15 A.M.	12	3
9:15 A.M.— 9:30 A.M.	11	7

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[1] Janet (pp. 114–116) expressed the belief that a division of labor exists in colonies of *Vespa crabro*, the recently emerged workers more frequently constructing the cells, while those of somewhat more advanced age usually tend to confine their activities to the envelope if they engage in building at all. He states that: "Even if individuals do not divide the work with precision among themselves, they appear, nevertheless, sometimes to specialize momentarily. Thus, I have noted several times that the same individual is frequently occupied during a day in doing the same tasks." (Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp. 1–140, with 41 figs.).

	Wasps carrying building material to nest	Wasps bringing liquid to nest
9:30 A.M. - 9:45 A.M.	10	4
9:45 A.M. -10:00 A.M.	10	6
10:00 A.M.—10:15 A.M.	11	5
10:15 A.M.--10:30 A.M.	12	5
10:30 A.M. 10:45 A.M.	7	13
10:45 A.M.—11:00 A.M.	7	9
11:00 A.M.—11:15 A.M.	9	6
11:15 A.M.—11:30 A.M.	7	9
11:30 A.M.—11:45 A.M.	10	9
11:45 A.M.—12:00 P.M.	6	9
12:00 P.M.—12:35 P.M. (observations omitted)		
12:35 P.M.—12:45 P M.	4	3
12:45 P.M.- - 1:00 P.M.	6	4
1:00 P.M. 1:15 P.M.	3	4
1:15 P.M. - 1:30 P.M.	2	2
1:30 P.M.- - 1:45 P M.	1	2
1:45 P.M. – 2:00 P.M.	1	1
2:00 P.M.— 2:15 P.M.	1	2

The record is of interest in that it demonstrates an accelerated slackening of building activity as the day advanced until by early afternoon labor was virtually suspended and only occasionally and sporadically would a wasp give any attention to the nest structure. The record is furthermore of interest in that it shows the progressively greater proportion that the cargoes of liquid bore to those of solid materials as the hours advanced. This might seem to cast serious doubt on the interpretation suggested above that the liquid is distributed primarily to make the building material soft and pliable instead of solely as refreshment for the workers. But it must be remembered that in the rainy season, when these observations were made, the dew is very heavy and that during the early morning hours before the sun has had a chance to absorb the moisture everything is damp or dripping. Under such circumstances the building material is doubtless initially much more moist than is the case later in the day and a smaller admixture of liquid.might, therefore, suffice to make manipulation of it easy.

The building activities of Nov. 13 as above indicated may be contrasted with the slackened efforts some ten days later, when only the occasional strengthening of the supports of the nest engaged the attention of the wasps. Thus the record for Nov. 22 reads:

	Wasps carrying building material to nest	Wasps bearing liquid to nest
8:15 A.M. — 8:30 A.M.	1	0
8:30 A.M.— 8:45 A.M.	1	1
8:45 A.M.— 9:00 A.M.	2	0
9:00 A.M.— 9:15 A.M.	0	0
9:15 A.M.— 9:30 A.M.	2	0
9:30 A.M.— 9:45 A.M.	1	0
9:45 A.M.—10:00 A.M.	2	0
10:00 A.M.—10:15 A.M.	0	1
10:15 A.M.—10:30 A.M.	0	0
10:30 A.M.—10:45 A.M.	0	0
10:45 A.M.—11:00 A.M.	0	0
11:00 A.M.—11:15 A.M.	0	0

We have reviewed the partitioning of the building material after it is brought to the nest, but what is the actual technique of building? When the original lump of material has been fractioned among a number of individuals, each has her bit adhering to the under part of her head immediately in back of the mandibles. It is, as a rule, so tiny that the assistance of the front legs is no longer needed to hold it in place. Let us observe a wasp applying her bit to a ridgelike surface,—for instance one of the stalactites. She places herself astride of the ridge with three legs on the one side and the opposing three legs on the other. Thereupon, moving backward, she trails the little lump along the edge of the ridge, spreading it over the surface. Simultaneously by incessant play of her mandibles she pinches and pats the newly laid-down material, thinning and firming it as she backs along. Not content with this, when the layer of building material has been applied, she again goes to the starting point and, once more moving backward, perfects her task by giving the ridge another series of pinches with her mandibles, thus insuring the more complete cohesion of the new material with the material previously laid down and compressing it to the requisite thinness. In one or two cases I thought I detected a slight assistance on the part of the front legs in this squeezing act but the main task of shaping the material nevertheless certainly devolves upon the mandibles.[1]

When it is a flat surface as distinguished from a ridge to which the new material is to be added, the technique differs. If, for instance, the roof of the nest is to be strengthened by an added coating of material or if the attachment of the envelope to one of the leaves is to be reinforced, the wasps seem more or less to push or hammer the new materials into place. At such times there is a slight, quivering, up and down movement especially of the head and the fore part of the body as the wasps press the substance down, their drooping antennæ in contact with the surface.

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[1] Reaumur in his account of *Vespa crabro* indicates (pp. 177–178) that this wasp also lays a new layer of building material by walking backward and flattening the material with her mandibles. He states that in doing so she holds the pulp between her front legs. Like the subject of the present paper, she makes a point, after a layer has been laid, of going back over her task in order to improve her workmanship (Reaumur, M. de, 1742, Mémoires pour servir à l'Histoire des Insectes, VI, pp. 155–214).

Allusion has been made to the distribution among the nest occupants of what was almost certainly water, especially while building operations were in progress. An even more interesting phenomenon was the ejection of liquid by the wasps. I first witnessed this on the afternoon of Nov. 14, the day when to all practical purposes the nest structure had been completed. Between 4 P.M. and 5 P.M. of that day I noticed wasps on four occasions lean far out of the nest-hole, their front pair of legs swinging in air. Presently a drop of liquid, like a soap-bubble blown, would appear between their opened mandibles. If this did not fall readily of its own weight, it was given a push by the free front legs, being literally flung away.

Again on the morning of Nov. 15 I noticed wasps stretching out of the nest-hole, head downward, to let fall the shining globule of liquid that quivered between their widely opened mandibles. Although most of the ejections took place from the nest-hole, one individual on the roof also felt moved to rid herself of her store of liquid. Apparently careful not to moisten the nest, she walked, with what in a human being might have been described as punctilio, up to the edge of the roof. Then, leaning well over it, she disgorged her droplet into space.

These phenomena were observed repeatedly on succeeding days and it became a source of wonder whence all this liquid was derived and why it should be ejected. The very fact that it was ejected confirmed me in the belief that the distributions of liquid made during building operations were not primarily for refreshment.

These ejections of liquid from the nest-hole were usually particularly numerous in the morning hours. Between 8:05 A.M. and 9:30 A.M. of Nov. 16 no less than 76 drops were ejected by wasps that leaned out of the nest-hole for the purpose. During this period wasps on the roof of the nest dropped liquid thrice. In each such case they were careful to approach the edge of the roof before disgorging and the liquid fell free of the structure.

To indicate how much more frequent was the ejection of liquid in the morning hours of Nov. 16, for instance, than in the afternoon, I tabulate below the record kept over five minute intervals:

8:05 A.M.—8:10 A.M.	7 ejections
8:10 A.M.—8:15 A.M.	7 "
8:15 A.M.—8:20 A.M.	7 "
8:20 A.M.—8:25 A.M.	10 "
8:25 A.M.—8:30 A.M.	5 "
8:30 A.M.—8:35 A.M.	8 "
8:35 A.M.—8:40 A.M.	4 "
8:40 A.M.—8:45 A.M.	3 "
8:45 A.M.—8:50 A.M.	5 "
8:50 A.M.—8:55 A.M.	2 "
8:55 A.M.—9:00 A.M.	3 "
9:00 A.M.—9:05 A.M.	6 "
9:05 A.M.—9:10 A.M.	5 "
9:10 A.M.—9:15 A.M.	1 "
9:15 A.M.—9:20 A.M.	5 "
9:20 A.M.—9:25 A.M.	0 "
9:25 A.M.—9:30 A.M.	1 "
1 hour 25 minutes	79 "
average per 5 minutes	$4\frac{11}{17}$ "

1:20 P.M.—1:25 P.M.	5 ejections
1:25 P.M.—1:30 P.M.	1 "
1:30 P.M.—1:35 P.M.	3 "
1:35 P.M.—1:40 P.M.	2 "
1:40 P.M.—1:45 P.M.	1 "
1:45 P.M.—1:50 P.M.	2 "
1:50 P.M.—1:55 P.M.	2 "
1:55 P.M.—2:00 P.M.	5 "
40 minutes	21 "
average per five minutes	$2\frac{5}{8}$ "

3:00 P.M.—3:05 P.M.	0 ejections
3:05 P.M.—3:10 P.M.	2 "
3:10 P.M.—3:15 P.M.	1 "
3:15 P.M.—3:20 P.M.	1 "
3:20 P.M.—3:25 P.M.	0 "
25 minutes	4 "
average per five minutes	$\frac{4}{5}$ "

However, the number of ejections varied not only for different hours of the same day but for corresponding periods of succeeding days. In contrast to the 79 drops ejected between 8:05 A.M.—9:30 A.M. on Nov. 16, the corresponding period of Nov. 18 witnessed ejections of only 18, less than a quarter of the previous total. The rain gauge of the Barro

Colorado Laboratory indicated that there had been no rain on the night of Nov. 17-18, whereas $^{3}/_{100}$ inches fell between 8 P.M. Nov. 15 and 8 A.M. Nov. 16. Were these ejections an act of bailing and could this slight rain have penetrated the nest sufficiently to account for the difference in the number of the ejections? It seemed doubtful. The nest was well protected by the surrounding shrubbery, and even after a fairly heavy rain-fall that occurred around 1:15 P.M. on Nov. 16 the nest-envelope had the appearance of being dry.

Moreover, the wasps, with what had the semblance of intelligent foresight, seemed capable of taking measures against the threatened moistening of their roof. About 3:25 P.M. on Nov. 17 a very heavy, if brief, tropical storm burst. The storm was over at 3:40 P.M., and I hurried to the nest in time to witness a very interesting happening. The nest seemed to be dry; nevertheless the wasps were taking no chances. One of the leaves to which the nest was attached had a steep slant and shed water readily out into space without permitting it to wet the nest. The slope and position of two other leaves, however, were such that rain drops might readily trickle from them on to the nest. The thing that startled me was that on these two leaves, which were dripping wet from the penetrating rain, seven wasps were stemming the threatened inundation. Deliberately they sucked up the water, and then going down the leaves and across the roof to the edge of the nest they ejected the liquid clear of the structure. Again and again they went to and fro, performing this service.

Impressed by this experience, I resolved to create an artificial storm. On Nov. 18 there had been but a single ejection of liquid from the nest-hole between 12 P.M. and 12:30 P.M. This seemed, therefore, a favorable opportunity for observing whether water descending on the roof of the nest from the leaves would succeed in penetrating the nest in sufficient quantity to prompt bailing. Accordingly I poured several teaspoonfuls of water over the leaves supporting the nest, creating thin rivulets that flowed down on the roof. The wasps in numbers rushed out on the roof, where several large drops of water had gathered. Several of the wasps at once engaged in lapping up these drops as well as those that still lingered on the leaves. As before, they would swallow their sip, walk to the edge of the roof, regurgitate a drop and let it fall of its own weight or push it from their mouth with a stroke of one or both of their front legs. They cleared the nest of moisture above but left hanging below the envelope a large drop that remained there long after all lapping and ejecting activities had ceased.

I think the storm I created resulted in a much severer wetting than the sheltered nest would ordinarily have received from a natural fall of rain. Yet, thanks to the response made by the wasps in the emergency, I do not believe water penetrated the envelope. Certainly the number of ejections from the nest-interior as distinguished from the liquid dropped over the sides of the roof was not impressive. I have said that one drop was ejected from the nest-interior in the half hour preceding the experiment. In the half-hour period following the artificial shower there were three ejections, but two of these took place toward the end of this half hour when the wasps that had been lapping fluid on the roof had crawled back into the nest. In other words, the liquid ejected from the interior of the nest may have represented largely the residue of the water imbibed on the outside.

In the last-mentioned experiment the roof had been moistened only indirectly by dripping from the leaves. I wanted to test its resistance to moisture even more thoroughly. Accordingly, the next "cloud-burst" was made to descend directly on the roof itself. I filled a medicine dropper with water and squirted the contents over the entire roof. This time the wasps swarmed forth in even greater numbers, a few removing the water that had coursed to the lower part of the envelope while the majority were similarly engaged on the roof. So many wasps were assembled on the exterior, lapping up the water, that I let a few minutes go by until a fair part of the colony was again within the nest. Observations were then concentrated on the nest-hole. In the succeeding twenty minutes there were nine ejections of liquid from the nest-hole. In the next ten minutes there was one ejection, so that for the full half hour the number of ejections was ten. Two more ejections occurred during the succeeding ten minutes. The increased number of ejections after the inundation as compared with those before it occurred may have been due to moisture in the nest, the result of seepage through the envelope, but more probably it represented, as previously suggested, a final disgorging of the residues of liquid lapped up on the outside of the nest. In any event, the relatively restricted number of ejections tends to indicate that penetration of the nest by rain is not a satisfactory explanation of the origin of the liquid that I had seen ejected from the nest on numerous occasions.

But if rain does not enter the nest, is it possible that the heavy dews account for the presence of the water? The nest-hole is relatively small and it would seem unlikely that this insignificant portal could give admission to enough dew to necessitate bailing. Moreover, on the morning when the nest was opened, there was no trace of moisture within. The wasps, furthermore, do not permit the accumulation of moisture in the interior of their nest any more than they permit liquid to remain on the roof or the approaches to the nest. After making the above experiments on the exterior of the nest, I squirted a stream from the medicine dropper right into the nest itself. The reaction was, as I suspected it would be, one of feverish activity on the part of the wasps, which began as quickly as possible to clear the nest of this unexpected inundation. Indeed, with such rapidity did they eject drops out of the nest-hole that, if I had not had the kind aid of Mr. E. I. Huntington, I should, between observation of the nest and of my watch, certainly have lost track of the count. The record for the first eight minutes after the water had been injected into the nest reads:

1st	minute	51 ejections
2nd	"	30 "
3rd	"	22 "
4th	"	24 "
5th	"	18 "
6th	"	22 "
7th	"	9 "
8th	"	2 "
	Total	178 "

Thus in eight minutes the wasps bailed out more than twice the amount of liquid that they ejected during an hour and twenty-five minutes on the morning of Nov. 16, when 79 drops were regurgitated!

The experiments above recorded were made in the daytime. I wondered whether, if they were repeated at night, the colony would rouse itself in defense of the nest. Accordingly at 7 P.M. of Nov. 23, when it had been dark for some time and the stars were out, water was again squirted on the roof. One wasp came out of the nest and crawled on the roof but shortly reëntered the nest. Thereupon, after an interval of a few minutes, I squirted a light stream into the nest-hole itself. Instantly the wasps began ejecting the water but not quite so energetically as during the daytime experiment, or it may be that fewer devoted themselves to the task. Even so, more than 70 drops were ejected in about seventeen minutes. During the first part of this time the wasps made their ejections only from the nest-hole, but by and by four of them crawled out on the roof and cleared the water also from the external parts of the nest. They were still at work when I left about 7:30 P.M.

These evidences that both by day and by night the wasps stand ready instantly to bail out their nest make it seem unlikely that the early morning ejections of liquid represent accumulations in the nest of rain or dew. More likely these ejections represent a disgorging of water distributed or lapped up on the previous day. Yet I confess that this offered explanation, the only one available, does not wholly satisfy me. The ejections of liquid at times occurred in such number that it was hard to believe that enough liquid could have been imbibed on the previous day to account for them. Thus my record for Dec. 2, for instance, reads:

6:15 A.M.— 6:30 A.M.	18 ejections
6:30 A.M.— 6:45 A.M.	19 "
6:45 A.M.— 7:00 A.M.	(observations omitted)
7:05 A.M.— 7:15 A.M.	24 ejections (or at the rate of 36 ejections for the full fifteen minutes)
7:15 A.M.— 7:30 A.M.	18 "
7:30 A.M.— 7:45 A,M.	29 "
7:45 A.M.— 8:00 A.M.	20 "
8:00 A.M.— 8:15 A.M.	26 "
8:15 A.M.— 8:30 A.M.	18 "
8:30 A.M.— 8:45 A.M.	23 "
8:45 A.M.— 9:00 A.M.	19 "
9:00 A.M.— 9:15 A.M.	15 "
9:15 A.M.— 9:30 A.M.	10 "
9:30 A.M.— 9:45 A.M.	3 "
9:45 A.M.—10:00 A.M.	4 "
10:00 A.M.—10:15 A.M.	2 "
10:15 A.M.—10:30 A.M.	1 "

While these ejections were going on, building material was being brought in, and I also noticed the occasional arrival of wasps with water for distribution. Such distribution was made for the most part on the roof of the nest while the ejections took place largely from the nest-hole. In other words, the wasps that were ridding themselves of liquid were distinct from those that were receiving it in the course of the building operations. After 9 o'clock building activity, which had been in full swing till then, slackened perceptibly. After 10:30 it ceased, a time when ejections of liquid were likewise virtually suspended. But though building activity was not resumed and no building material was brought in during the afternoon, the lull in the ejection of liquid was only temporary Between 11:10 A.M. and 11:55 A.M. the record of ejections was as follows:

11:10 A.M.	11:25 A.M.	8 ejections
11:25 A.M.	11:40 A.M.	12 “
11:40 A.M.	11:55 A.M.	12 “

At 11:55 it began raining but soon stopped.
At 12:40 observations were resumed as indicated in the following record:

12:40 P.M. -12:55 P.M.	(sky slightly overcast)	20 ejections
12:55 P.M.– 1:10 P.M.	“ “ “	13 “
1:10 P.M.— 1:20 P.M.	(sky overcast and rain)	5 “
1:20 P.M.— 1:30 P.M.	(heavy pelting rain)	(observations suspended)
1:30 P.M.— 1:45 P.M.	(rain)	31 ejections (including many drops ejected from roof)
1:45 P.M. - 2:00 P.M.	(mostly overcast)	21 ejections
2:00 P.M. – 2:15 P.M.	(overcast)	18 “
2:15 P.M. 2:30 P.M.	“	13 “
2:30 P.M. - 2:45 P.M.	“	(observations suspended)
2:45 P.M. 3:00 P.M.	“	(observations suspended)
3:00 P.M. 3:15 P.M.	“	13 ejections
3:15 P.M. - 3:30 P.M.	“	21 “
3:30 P.M. 3:45 P.M.	(overcast and a few drops of rain)	23 “
3:45 P.M. 4:00 P.M.	(overcast)	21 “
4:00 P.M. 4:15 P.M.	“	19 “

My observations were not continuous but, even granting that there may have been some slackening or even suspension in the ejections during these gaps, the fact remains that for nearly ten hours there were ejections that rarely fell below the rate of one per minute and frequently exceeded that rate. It is hard to account for the source of all this liquid. Several times I noticed incoming wasps distribute water and probably there were other instances of this kind that escaped by attention, but these replenishments were trivial compared with the liquid disgorged.

Brief notation was made of the weather conditions in the record of Dec. 2. in the possibility that cloudiness may induce the wasps to regurgitate. Further observation on this point is desirable. It may well be that the negligible number of ejections on the afternoon of Dec. 3d, which are tabulated below, simply indicate that the reservoirs were empty after so plenteous a discharge on the previous day, but it is barely possible, too, that liquid was retained on Dec. 3 because of the sunny weather or the lower relative humidity or both.

The nest got the morning sun, not the afternoon, and the references to sunlight in the following table apply, therefore, to the general landscape; the nest, due to its sheltered position, was never sun-illumined in the afternoon.

Dec. 3, 1930

12:45 P.M.— 1:00 P.M.	(sunny and slight shower)	0	ejections
1:00 P.M.— 1:15 P.M.	(slightly overcast to sunny)	0	"
1:15 P.M.— 1:30 P.M.	(bright sunlight)	0	"
1:30 P.M.— 1:45 P.M.	" "	0	"
1:45 P.M.— 2:00 P.M.	(bright sunlight, then fairly heavy rain)	0	"
2:00 P.M.— 2:15 P.M.	(dull to bright sunlight)	0	"
2:15 P.M.— 2:30 P.M.	(mostly bright sunlight)	1	"
2:30 P.M.— 2:45 P.M.	(sunlight)	0	"
2:45 P.M.— 3:00 P.M.	(bright sunlight)	2	"
3:00 P.M.— 3:15 P.M.	(subdued sunlight)	0	"
3:15 P.M.— 3:30 P.M.	" "	0	"
3:30 P.M.— 3:45 P.M.	" "	0	"
3:45 P.M.— 4:00 P.M.	' "	0	"
4:00 P.M.— 4:15 P.M.	(late afternoon light)	0	"

The relative humidity record for the days and hours covered in the above tabulations was as follows:

Dec. 2, 1930		
	6 A.M.	95
	8 A.M.	96
	10 A.M.	96
	noon	78
	2 P.M.	92
	4 P.M.	94
Dec 3, 1930		
	noon	75
	2 P.M	70
	4 P.M.	75

On an earlier page, allusion was made to the action of the wasps in removing raindrops from a leaf that sloped down upon the nest, thereby eliminating a danger before it had a chance to threaten. In the end, however, the wasps solved this difficulty in a still more adroit and summary manner, namely, by removing the leaf itself. One lone individual or another had, even during the earlier history of the nest, made now and then a sporadic effort to get rid of some of the vegetation. Thus, what I like to describe as the roof-tree—the little twig to which the nest was attached and solely attached in its incipient stage—had originally terminated in an end leaf flanked by two other leaves. These leaves I had snipped off in order the better to see the nest, but the stems were still in place and indeed frequently served as a kind of perch from which foraging wasps took flight. During the morning of Nov. 15 two of these stems (those representing the flanking leaves) were neatly bitten off at the base by one of the wasps. In the course of the morning of Nov. 26 I noticed a wasp bearing a fragment of a leaf as she moved across the roof of the nest. Presently she transmitted this fragment to another wasp, which thereupon walked to the edge of the roof and dropped the fragment over the side.

On Nov. 30 the major operation of this character, requiring the united effort of several wasps, took place. Nov. 28–29 had been a period of especially heavy rain, with comparatively little fair weather. For the twenty-four hours from 4 P.M., Nov. 28, to 4 P.M., Nov. 29, the rain gauge recorded 3½ inches. On the morning of Nov. 30 about 9 o'clock I went to take a glance at the nest and to my surprise found the wasps engaged in removing one of the leaves that was in contact with the nest. The leaf in question was only partly attached to the roof (the portion that had been built into the roof measured only about 11 mm. by 6 mm.) and much of its undulating surface stood free of the nest. Had its tip extended beyond the nest it might have served as a watershed; instead it acted as a conduit, discharging the growing rain drops on the roof. When my observations were begun, the work of demolition had already progressed considerably. The leaf—or rather what was left of it—had a soft, moisture-soaked, flimsy appearance, which may have been caused by the rain but more likely was due to squeezing by the mandibles of the wasps. The texture of the leaf was in contrast to that of the shiny, smooth surface of the healthy leaves of the shrub. Several wasps were engaged in removing the leaf. They worked not only on its edges, astride after the manner of leaf-cutting bees (*Megachile*), but above and even below the leaf, and little rents that were visible here and there on the surface of the leaf seemed due almost certainly to the nibbling and ripping action of this wrecking crew. The work was hard for the wasps. They seemed not so much to cut as gradually to tear the leaf to pieces. Sometimes a substantial leaf particle would be loosened through the joint action of several wasps, and its further fragmentation would then take on the aspect of a tug of war.

When a single wasp, however, remained in possession or ultimately achieved ownership of a detached fragment, the method of disposal was usually the same. The wasp would carry the leaf particle beneath her body, holding it with her mandibles and usually supporting it in addition with the front pair of legs. Instead of dropping the leaf particle over the side of the nest, however, as had been done in the case of the water drops, she took to her wing with the green burden, wheeled in air till she faced the nest at the distance of a foot or more, and then darted off into space. This was the almost invariable procedure. Only one wasp was observed to walk to the edge of the nest and drop her burden over the side without going through the formality of flight. Occasionally particles were not retained by the wasps or got away from their control in the course of their struggles, slipping of their own accord down the sides of the nest and so to the ground. No attempt was made to recover such particles.

The leaf was in process of destruction when I witnessed the incident around 9 A.M. Its free parts had been completely removed shortly after 10 A.M. That portion of the leaf which was attached to the nest and which constituted indeed an essential part of the architecture of the nest was not tampered with.

The distribution of water among the individuals on the roof of the nest was a relatively calm and unemotional procedure with brief contact of the mouth-parts as the droplet was transferred from distributor to receiver. In contrast to this was the vivid agitation that was observed every now and then when a returning wasp would arrive at the nest bearing something that was evidently eagerly desired by the nest occupants. These would hurry toward her expectantly or thrust their heads out of the nest-hole in anticipation. The arriving wasp and the recipient would take a position more or less at right angles to each other. One of them would lean to one side and tilt her head until it was almost vertical or at least oblique to the horizontally held head of the other. In this position their mouth-parts were brought into prolonged and intimate contact, while their antennæ were in lively agitation. At times the individual holding her head sideways would lose her balance and fall partly on her side, but even under such circumstances the two wasps would still cling in close embrace with their mouth-parts joined.

For a long time these actions mystified me. The mouth-parts were so closely interlocked that I usually failed to detect the transfer of any substance. Once, however, I was able to note a tiny drop of liquid (probably nectar), and on another occasion I was under the impression that something pastelike was transferred.[1] Almost invariably the first recipient would at the termination of the contact crawl into the nest, and this circumstance and the fact that I had noted the transfer of the tiny drop led me to conclude that the incoming wasps were bringing food, which, paralleling the procedure in the case of the building material, was handed over by the forager to a waiting nurse before being fed by her to the brood. If this was the case, however, it was the first recipient that usually obtained, I think, the lion's share and the one on whom apparently devolved the duty of feeding the young. The wasps next in line had usually briefer contacts with the forager and, unlike the first recipient, did not on separation head for the interior of the nest. Possibly they shared only the dregs or their efforts may even have gone unrequited. Not infrequently even wasps on the nest itself would approach one another and engage in this interlocking of mouth-parts, possibly merely in futile gesture.

The number of these contacts as recorded on Nov. 22 was as follows:

8:15 A.M. 8:30 A.M.	1
8:30 A.M. - 8:45 A.M.	7
8:45 A.M. 9:00 A.M.	6
9:00 A.M. - 9:15 A.M.	1
9:15 A.M. - 9:30 A.M.	5
9:30 A.M. - 9:45 A.M.	6
9:45 A.M. -10:00 A.M.	2
10:00 A.M. - 10:15 A.M.	5
10:15 A.M. 10:30 A.M.	2
10:30 A.M. 10:45 A.M.	4
10:45 A.M. 11:00 A.M.	2
11:00 A.M. 11:15 A.M	4

Because of the frequency with which these contacts occurred and on the theory that they represented transfers of nutriment, I was almost tempted to conclude that regurgitated food might be the only kind fed to the larvæ. But at 11:30 A.M. on Nov. 22 I noted a wasp bearing in what seemed to be a small greenish-white larva[1] and almost immediately thereafter another wasp arrived similarly laden. Both of them flew directly into the nest-hole, where they were met by other wasps. Thereupon there occurred what seemed to be a partitioning of the material among the adult wasps within the nest. On Dec. 2 I had two opportunities to verify this observation. The wasps laden with food, instead of flying into the interior of the nest, alighted on the roof and there in full view the food was partitioned[2] much as building material had been subdivided on other occasions. The process of preparing the food was deliberate. The worker receiving a share would hold the tit-bit with her front legs while malaxating it. Finally she would enter the nest presumably to feed the larvæ within. Because in the early history of the nest no instances were observed of wasps arriving with prey, I came to wonder whether the younger larvæ were fed on regurgitated food only (possibly mostly nectar) while the malaxated caterpillars were reserved for those farther along in development.[3] Where many phenomena are offered for observation, it is necessary, however, to concentrate on one phase or another, and my preoccupation with other nest activities may have resulted in my overlooking food-gathering acts during the first two weeks.

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[1] Janet, in discussing (p. 105) the transfer of liquid nutriment among the adults of *Vespa crabro*, says: "The queens, when the day comes that they no longer leave the nest, and likewise the newly emerged workers are nourished principally by liquid which, upon their solicitation, their companions disgorge before their mouth

"I have seen a queen, in order to eat, force herself between two workers engaged in sipping the liquid which one of their companions disgorged for them, so that food was being dispensed to three hornets at one time.

"When a worker disgorges liquid nutriment for one of her companions, it is rather easy to distinguish the one that gives from the one that receives. The one that gives has the mandibles and also the antennæ widely spread apart. The one that receives has the mandibles close together and the antennæ are most frequently brought into contact with the mandibles of her companion in order to palpate them." (Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp. 1–140, with 41 figs.)

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[1] In the case of the South American representatives of *scutellaris* mature forms rather than larvæ seem to constitute the prey. Von Ihering (p. 45) states that in Brazil *scutellaris* always brings in the prey unmalaxated, although more or less mutilated, with the wings of the victim invariably removed. He mentions houseflies and termites as the principal objects of the chase (Ihering, H. von, 1896, Zool. Anzeiger, XIX, pp. 449–453). Of a colony of *Polybia scutellaris* var. *paulista* von Ihering says: "The larvæ were provided with various insects, flies (*Musca domestica* L.) and winged ants (*Solenopsis geminata* F.), all deprived of their wings and in part of their extremities." (Ihering, H. von, 1896, Bull. Soc. zool. de France, XXI, pp. 159–162.)

Wasmann (p. 277) quotes P. A. Schupp (Natur und Offenbarung, 1896, pp. 143–151) to the effect that *scutellaris* removes not only the wings of flies but bites off also the legs and if, notwithstanding these mutilations, the prey is still too heavy, trims off likewise a part of the body. Termites were similarly reduced to a portable size. Wasmann adds that he had opportunity to examine prey secured from *scutellaris* nests collected in different localities and in different years. In all cases the termites were *Eutermes ater* although the closely related *Eutermes tenebrosus* is known to occur in the same region. The condition of these termites was as follows:

"From most of them the wings had been bitten off near the base, likewise the legs, at least most of the legs. In the case of three-fourths of the total number of specimens the heads were missing, those of the larger individuals invariably, those of the smaller more rarely. Even in the case of the latter, however, the antennæ were entirely or partly bitten off. Some specimens, on the other hand, still retain their wings, at least in part; others still have an uninjured antenna; such specimens are invariably small individuals. Most of the specimens are ♂♂, but I was able to recognize with certainty in spite of desiccation also several ♀ ♀ by the rounded hind margin of the larger sixth ventral segment. Many of the specimens that still retained their heads had received a bite in these parts from the mandibles of the wasps." Wasmann found also among the prey various ants: males of *Dorymyrmex pyramicus*, some wholly or nearly unmutilated, others with head or antennæ or legs removed or wings reduced to stumps; 2 ♂ ♂ of a species related to *Wasmannia auropunctata;* finally a ♂ of *Ponera punctatissima* var. *trigona*." (Wasmann, E., 1897, Zool. Anzeiger, XX, pp 276–278.)

More than once in the course of my observations of the Barro Colorado nest a small ant by chance or design crawled on to the roof of the nest. She was always menaced immediately by one of the workers and forced to a hasty retreat, but never was an attempt made to seize her as food.

Simulid flies have also been reported to be the prey of *scutellaris*, the wasps actually seizing the flies from the cattle that they were victimizing (Bertoni, A. de W., 1912, Anales del Museo Nac. de Hist. Natur. de Buenos Aires, (3) XV, pp. 119–120).

[2] Janet indicates (pp. 28, 63, 98) that in the case of *Vespa crabro* an unwieldy mass of food may be distributed among the workers by a returning forager and that even the queen may take over a share of the load; transfers *in toto* of the food sometimes take place (Janet, Charles, 1895, Mémoires de la Société zoologique, de France, VIII, pp. 1–140 with 41 figs.).

Williams observed (p. 163) a returning forager of *Stenogaster varipictus* engaged in dividing a load of food with one of the adult wasps of the nest (Williams, Francis X, 1928, Bull. Exp. Stat. Hawaiian Sugar Planters' Assoc., Entom. Series, No. 19, pp. 1–179 with text figs.).

[3] Since hazarding this interpretation I have come upon the interesting paper by Rau (Rau, Phil, 1928, Biol. Bull. Woods Hole, LIV, pp. 503–519 with 1 fig.) in which he presents evidence for believing that the young larvæ of *Polistes pallipes*, *P. annularis*, and *P. variatus* are fed on regurgitations of honey. Rau cites Sharp's Insects, part 2, p. 84, that "saccharine matter" is the first food given to some unspecified social wasp. Rudow, too, states (p. 81) that "often several females (of *Polistes*) participate in the first construction and feed the larvæ with the fragrant honey of umbelliferous plants," (Rudow, Dr., 1913, Ent. Rundschau, XXX, pp. 69–69, 74–76, 81–82, 88–90, 100–102, 112–114, 118–120, 125–126.)

The bringing in of the prey occurred very irregularly. Just as on Nov. 22 I noted the almost simultaneous arrival of two laden wasps, so on Dec. 3 several wasps bearing what seemed to be small larvæ arrived in rapid succession—1 P.M., 1:05 P.M., 1:06 P.M., 1:07 P.M.—after which there was a gap of nearly an hour (2:02 P.M.)—before another forager arrived. The latter was followed at 2:26 P.M. by another laden individual. No other instances of larva-bearing foragers were noted subsequently on that afternoon. The swift succession of arriving wasps followed by the long gap of inactivity suggests the possibility that a single source of supply was raided and perhaps exhausted.[1]

Just as the wasps got rid on occasions of undesired liquid, so likewise they would drop from the nest-hole solid particles that were not wanted. Once or twice after a distribution of building material I noticed that what seemed to be a residuum of such material was flung out. On several occasions in the course of the afternoon of December 3 wasps stretched out of the nest-hole to divest themselves of crumblike particles, possibly remnants of food, as no building material had been brought in during the afternoon. They seemed in these instances to be making their toilet. While the nest was in course of construction, I had several times noticed wasps performing a cleansing act. Sometimes they would make a tripod of the anal end of their abdomen and their hind legs while brushing themselves with their front and middle legs. On two occasions at least I noticed a wasp that was attached to a cell by its mandibles, hanging thus with only the additional support of its front legs while it scraped its pendant body with its middle and hind legs.

On several occasions one or another wasp on the nest engaged in more or less prolonged vibration of its wings.[2] Such cases were observed even while building operations were in progress and when the explanation could hardly have been that of ventilating the nest. It is barely possible that such fanning served the purpose of drying the building material more rapidly, but, if so, I think this was merely incidental to what was probably a purposeless act. Similar acts after the completion of the nest may also have been purposeless, but sometimes the position taken by the wasp suggested an attempt on her part to ventilate the interior. Thus, on Nov. 14, I noticed a wasp standing above and just to the right of the nest-hole, with her front legs raised and her middle legs placed at the edge of the hole, while she was vibrating her wings vigorously and protractedly and almost inevitably cooling the interior.

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[1] Wasmann (p. 277) quotes P. A. Schupp to the effect that hundreds of wasps of *scutellaris* arrived at the nest simultaneously, laden, one and all, with termites. (Wasmann, E., 1897, Zool. Anzeiger, XX, pp. 276–279.)

[2] Janet states (p. 111) of *Vespa crabro*: "It is not unusual to see one or two hornets stationed on the envelope of the nest or under the cell-containing combs, and violently beating their wings. This beating of the wings which produces a rather audible sound and an energetic ventilation appears to me to be often only a manifestation of anger, a menace and as a result a means of defense." (Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp. 1–140, with 41 figs.)

Janet's interpretation would not, I think, apply to the behavior of *scutellaris*. The wasps engaged in vibrating their wings were lone individuals performing solo and gave no evidence of directing their "anger" against any offender.

The most prolonged vibrating of the wings that I observed on the part of any wasp came to my attention on Nov. 21. From 1:48 P.M., when I arrived at the nest, until 2:10 P M., I noticed a wasp with her wings almost continuously aquiver. How long before 1:48 P.M. she began vibrating her wings I do not know. During this long demonstration of more than twenty minutes she took positions, for the most part, fairly close to the nest-hole, now on one side of it, now on the other, and below as well as above it, often with the feet of one side of her body holding to the edge of the hole. While she was vibrating her wings, she had the singular mannerism of rubbing her right antenna with her right leg, and it was because of this peculiarity of behavior that I felt justified in believing that a wasp which I observed subsequently that afternoon in the act of vibrating and which was characterized by a like idiosyncrasy was the same individual. This time I had opportunity to observe her in action from 3:35 P.M. to 4:25 P.M. How much before 3:35 P.M. she had begun vibrating her wings or how long after 4:25 P.M. she kept it up, I cannot say. Perhaps she had been thus engaged almost continuously from 1:48 P.M., when my first observation was made. Although in the course of this long period she moved about and occasionally wandered rather far from the nest-hole, for the most part she stood so close to it that I was under the impression she was engaged in ventilating the interior.

When the nest was collected, I proceeded to measure its external parts (the measurements are given in the earlier part of this paper) and then proceeded to open it from below, revealing the larger of the two combs. This consisted of approximately 280 cells, each measuring just under 3 mm. in diameter.[1] The larger larvæ occupied the cells near the center of the comb and there was a gradual tapering off in the size of the larvæ as the periphery of the comb was approached. The arrangement was, however, not absolute, for even in the cells near the center there were larvæ of intermediate size interspersed with full-grown larvæ. Nevertheless, the general arrangement was such as to suggest that egg-laying had begun at the center and had spread thence out toward the circumference.[1] The two rows of cells constituting the periphery were devoid of contents, while in the row inward of these there was only an occasional occupant. There were 131 larvæ in the cells of this larger, lower comb and eight additional, full-grown larvæ that had wriggled out of their cells (presumably vacated ones near the center of the comb) were found on the floor of the envelope.[2] In addition to the larvæ there were in this larger comb six eggs. These were fastened by their smaller axis to the point of junction of the base of the cell with one of the sides and they thus hung downward at a slight angle.

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[1] R. von Ihering records (p. 256) the diameter of the cell of the Brazilian representatives of *scutellaris* as 2.8 mm. (Ihering, Rudolf von, 1904, Revista do Museu Paulista, VI, pp. 95–309.)

The entrance to the smaller or upper comb (the original entrance to the nest before the second or lower comb was built) was larger than the outer entrance (the final nest-entrance). It measured 1¾ cm. by 9 mm. The approximately 109 cells of the upper comb were in places rather irregularly linear in arrangement, making an accurate count difficult. The irregularity was even more striking in the case of the depth of the cells. In contrast to the gradual, symmetrical convexity from circumference to center noted in the case of the lower comb, the cells of this upper comb showed a notable difference of level, some towering above others and presenting a jagged appearance. I think it possible that they were enlarged after the completion of the nest-envelope concealed activities within the nest. I do not recall such irregularities when the comb was in its initial stage and still exposed. After the completion of the external architecture of the nest on Nov. 13, building material was still from time to time taken into the nest and it may be that it was applied to the lengthening of these cells.

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[1] This more or less concentric arrangement of the different stages of the brood has been frequently observed in the case of the social Hymenoptera. Janet (Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp. 1–140) has published a series of diagrams showing the increase in numbers of the brood and the development of the individual members day by day in a nest of *Vespa crabro*, and these diagrams clearly indicate that laying begins near the center of the comb and continues thence toward the peripheries. Ritchie (Ritchie, James, 1915, Scottish Naturalist, 1915, pp. 318–331) on p. 319 speaks of the immature forms of *Vespa vulgaris* as lying "in successive waves of life outwards from the center of the comb." Schmidt (Schmidt, Hugo, 1917, Zeitsch. wissensch. Insektenbiol., XIII, pp. 153–160) indicates (p. 155) that at the center of one of the combs of *Vespa germanica* were the capped cells, beyond these were cells containing larvæ while the cells near the circumference were empty. In nests of meliponid bees it is, according to von Ihering (Ihering, H. von, 1904, Zool. Jahrb. Syst. Geogr. u. Biol., XIX, pp. 179–287) the central part of the comb from which the imagos first emerge. Concentric arrangement of the brood occurs also in the honey bee, *Apis mellifica*.

[2] These larvæ were still alive. They squirmed about and though legless were capable of slight progress. Ritchie (p. 318), who injected at night a few drops of "aqueous solution of potassium cyanide" [illegible] ...ity." Ritchie concludes: "This resistance to the cyan[illegible] rate of metabolism in the larvæ than in the adult wasps." (Ritchie, James, 1915, Scottish Naturalist, 1915, pp. 318–331.)

In this upper comb there were 20 capped cells, all located near the center of the comb, but with four uncapped cells scattered among them. One of these uncapped cells had a larva of fair size, the remaining three contained eggs. The silken caps of the closed cells were white, and rose in cylindrical shape about 4 mm. above the cell itself. When one or more of these capped cells were opened, they proved to have larvæ of a stage of development like that of the full-grown larvæ of the lower comb. I suspect that the capping of the cells had taken place only a little time before the nest was opened and that the full-grown larvæ of the lower comb would very shortly have presented the same condition.

The time from the laying of the egg to the capping of the cell could not, therefore, have occupied much more than three weeks and may have occupied less, all depending on when oviposition occurred. As to this, one can merely speculate. My impression is that oviposition probably began very shortly after the construction of each of the combs. This would make the time from the laying of the egg to the attainment of full size by the emerging larva approximate that recorded for *Vespa vulgaris.*[1] Janet[2] has shown in the case of *Vespa crabro* that the egg stage may last from four days to twenty-one days while that of the larva is completed in from eight days to nineteen days, depending on conditions of temperature and other factors. A minimum of thirteen days from the laying of the egg to completion of the larval stage would thus seem to be indicated for *Vespa crabro*, and this suggests the possibility that, in the case also of the Barro Colorado wasp, development may have been accelerated. In this connection it is interesting to compare observations made on *scutellaris* in Brazil. H. von Ihering states that in that country new nests of *scutellaris* having three or four combs reveal themselves when opened as still completely devoid of eggs. Once, however, von Ihering did find even in Brazil a nest of three combs in which brood was already present.[3]

That portion of the upper comb that contained the capped cells was brought to New York. About six weeks later (Jan. 24, 1931), as no wasps had emerged, these cells were opened. In all but two cases they contained wasps that after completing their development had died without piercing the silken barrier, which became their shroud. Is it possible that the aid of the free-moving adult wasps was needed to liberate these prisoners?[1] In addition to the capped cells, the upper comb contained 16 larvæ and six eggs. The larvæ of this upper comb graded off in size toward the circumference just as did the larvæ in the lower comb.

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[1] "In the common wasp [*Vespa vulgaris*] the larva is hatched 8 days after oviposition, it grows to its full size in 12 or 14 days, then spins its delicate hood, casts its integument . . . . and after a passive pupa state of 10 days emerges a perfect insect." (Owen's 'Invertebrate Animals,' cited by Ritchie, James, 1915, Scottish Naturalist, 1915, pp. 318–331.)

[2] Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp. 1–140, with 41 figs.

[3] Ihering, H. von, 1896, Zool. Anzeiger, XIX, pp. 449–453.

Among the 130 adult wasps taken with the nest, which constituted the entire colony except for at most three or four that escaped, there was not a single male.

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[1] Janet notes (p. 85) that in exceptional cases workers of *Vespa crabro* perforate the cap of the cell several days before the emergence of the adolescent wasps (Janet, Charles, 1895, Mémoires de la Société zoologique de France, VIII, pp. 1–140, with 41 figs).

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CRYSTALLOGRAPHIC STUDIES OF FLUORITE

By Herbert P. Whitlock

The Bement Collection of Minerals, which was presented to the American Museum by the late J. Pierpont Morgan, Esq., in 1900, is particularly rich in crystallized fluorite. A recent intensive survey of this series indicated several occurrences as likely to provide appropriate matter for study from the point of view of new and rare form combinations as well as providing interesting examples of parallel growth phenomena.

1. FLUORITE FROM PHOENIXVILLE, PENNSYLVANIA

Material for the study of this occurrence was furnished by three specimens, numbered 3059, 3060 and 3061, obtained from the Wheatley Mine at Phoenixville, Pa. Like all of the best specimens from this famous locality, these represent old finds.

No. 3059, originally from the collection of J. D. Whitney, was probably collected by him prior to its sale to Mr. Bement at some time close to the middle of the last century. No. 3060, from the collection of the late Joseph Willcox of Philadelphia, was purchased by Mr. Bement at some time prior to 1891 when the remnant of the Willcox Collection (after sales to Bement and to the British Museum) was deposited in the U. S. National Museum. No. 3061 was obtained by Mr. Bement from the late Samuel Tyson, a collector of the town of King of Prussia, not far from Phoenixville. From certain indications on the original (Tyson) label, it is probable that this specimen like the others was obtained about the middle of the last century.

No adequate description of the fluorite crystals from Phoenixville has, to the knowledge of the writer, ever been published. J. Lawrence Smith,[1] writing in 1855, designated them as small, colorless and transparent, and stated that the cube is much modified by the truncations of angles and edges. The same author gives the results of an analysis in which he found fluorine 48.29% and calcium 50.81%, thus indicating a fluorite singularly free from impurities. The series of three crystals that were studied by the present author were obtained from specimen No. 3060. They are clear, colorless and measure about 1 mm. in diameter. On this specimen the fluorite crystals are thickly implanted on scalenohedral calcite in such a manner that the points of attachment represent very small relative areas. The crystals are cubic in habit, highly modified especially on the cube corners, and are sharp and brilliant. During the measurement with a Goldschmidt Two-circle Goniometer, it was noted, upon centering on a trapezohedral face with the combination of lenses giving the higher magnification, that, in addition to the reflection from the trapezohedral plane, four reflections from the two rare hexoctahedrons were also observed in the field as clearly defined images of the signal.

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[1] Amer. Jour. Sci., 1855, (2) XX p. 242.

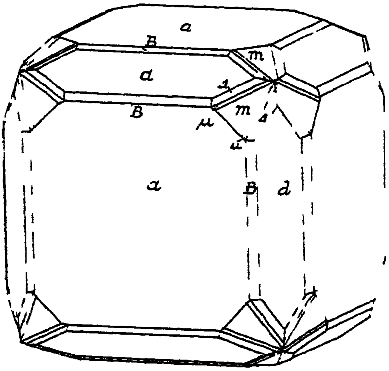

Figure 1

The following forms were observed:—a(100), d(100), B(037), m(113), Δ(3.5.11) and μ(5.7.17), the last named being new to the species. Figure 1 shows these crystals in ideal proportion.

B(037). This rare tetrahexahedron has been cited by several authors, notably by Von Calker,[1] who observed it as a corrosion form on fluorite from Zinnwald. In the present instance it was recorded from a number of planes on Crystal I, the average of ten readings giving $\rho = 23°$ 12.8′ as compared with a calculated value for this angle of 23° 13′.

Δ(3.5.11). This hexoctahedron is among the earliest forms recorded for fluorite. G. Rose[2] in 1828 described and figured a combination from

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[1] Zeitschr f Kryst, 1887, VII, 45
[2] G. Rose, 1828, Pogg Ann, XII Plate IV, fig 6

Weardale, Cumberland, on which the zone [113.011] is emphasized by (3.5.11) and (124) beveling the edges between 011 and 113 in proportions that strongly suggest the crystals under discussion

μ(5.7.17). This new hexoctahedron also lies in the zone [113.011] close to (3.5.11) but sharply defined from the latter form. On the three crystals selected for study, readings on no less than 47 faces of (5.7.17) were obtained, a most unusual circumstance when considered in connection with a new crystal form.

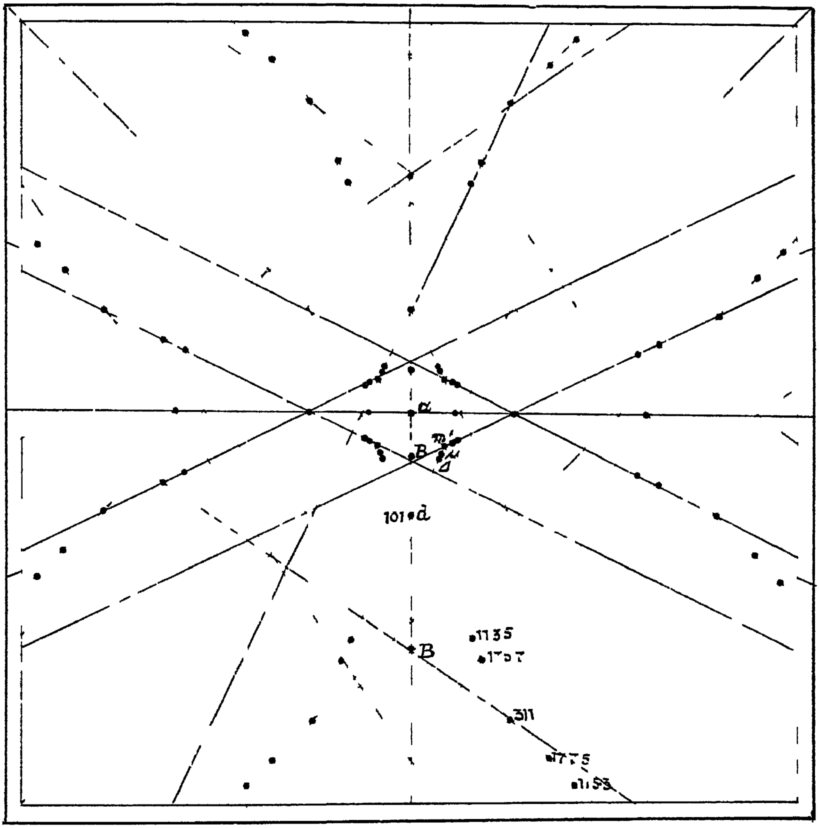

Figure 2

The zonal relations of the forms occurring on the fluorite from Phoenixville are shown in gnomonic projection in figure 2.

A single crystal measuring about 5 mm. in diameter and showing the habit of figure 1 was noted on specimen No. 3061 implanted on brownish dolomite.

Crystals of larger size and simpler in habit implanted on calcite and representing an earlier generation of fluorite formation were noted on specimen No. 3059. These are cubic in habit with a relatively small development of *m*(113).

The forms μ(7.5.17) and Δ(5.3.11) were identified by the following series of measurements determined on a Goldschmidt Two-circle Goniometer.

	Form	Crystal I			Crystal II			Crystal III			Average			Calculated	
		φ	ρ	N	φ	ρ	N	φ	ρ	N	φ	ρ	N	φ	ρ
μ	7·5·17	35° 35′	26° 50′	7	35° 40′	26° 49′	4	35° 7′	26° 56′	4	35° 29′	26° 51′	15	35° 32′	26° 50½′
	17·7·5	22 29	74 54	5	22 17	74 41	6	22 19	74 47	6	22 21	74 47	17	22 23	74 47
	17·5·7	16 21	68 21	5	16 30	68 36	6	16 22	68 35	4	16 25	68 31	15	16 23	68 26½
Δ	5·3·11	31 12	27 54	7	31 7	27 54	8	31 47	27 56	3	31 14	27 57	18	30 58	27 55½
	11·5·3	24 20	76 3	4	24 17	75 56	6	24 8	76 3½	6	24 14½	76 1	16	24 27	76 3
	11·3·5	15 15	66 22	5	15 30	66 17	6	15 13	66 31	3	15 21	66 22	14	15 15	66 19

Table 1

2. PARALLEL GROUPING ON FLUORITE CRYSTALS

Two instances of grouping of fluorite crystals in parallel position were encountered in the course of the above mentioned survey. These seem noteworthy because of their rarity and because of the possible implications suggested by their habit.

A small specimen from Zinnwald, Czechoslovakia, numbered 2643, was obtained by Mr. Bement, early in the formation of his collection, from H. Hoseum of Bazel, Switzerland.

The fluorite consists of light violet implanted octahedra, the largest crystal measuring 5 mm. in diameter. These are encrusted with minute purple tetrahexahedra in parallel grouping and so disposed as to form in lines perpendicular to the nearest octahedral edge. Figure 3 suggests the singular grouping of these small crystals which are obviously of a later generation than the octahedra on which they are implanted.

A specimen of light green fluorite, purchased by Mr. Bement between 1870 and 1875 from Dr. Krantz in Bonn, Germany, is octahedraldodecahedral in habit. The light green crystals, which average about 12 mm. in diameter, are frequently crowned by light violet red cubic crystals of a later generation in parallel position, as shown in figure 4. In some instances the second generation crystals show a slight beveling of the cubic edges by the dodecahedron.

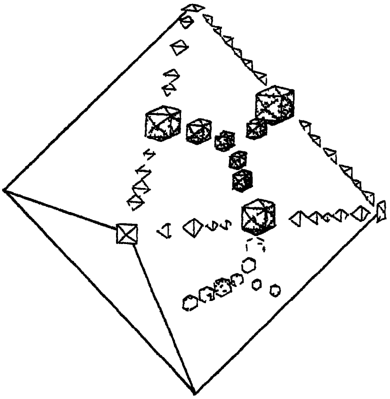

Figure 3

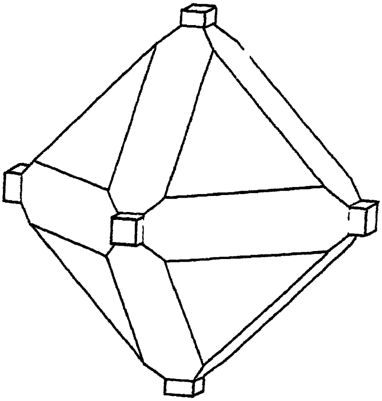

Figure 4

AMERICAN MUSEUM NOVITATES

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A REVIEW OF WILLIAM DILLER MATTHEW'S CONTRIBUTIONS TO MAMMALIAN PALÆONTOLOGY

By William K. Gregory

The late William Diller Matthew, Professor of Palæontology and Director of the Museum of Palæontology in the University of California, and for many years Curator of the Department of Vertebrate Palæontology in the American Museum of Natural History, left to the world a legacy in the form of some two hundred and forty-four scientific papers, which deal for the most part with mammalian palæontology. He also imparted to many of his students and junior colleagues an active interest in palæontological exploration and in the advancement of the great theme of mammalian evolution to which he had contributed so much. Various general biographical articles[1] on Doctor Matthew having already been published, it would now seem both timely and useful to attempt a special review of his chief contributions to mammalian palæontology.

HIS EARLIER CONTRIBUTIONS TO KNOWLEDGE OF RECENT AND FOSSIL MAMMALS

Soon after Doctor Matthew's coming to the American Museum of Natural History in 1895, he was sent by Professor Osborn to Philadelphia to catalogue, pack up and ship to New York the great collections of Professor E. D. Cope, which had been purchased by the Museum. In this way Matthew came to know and admire Professor Cope and began the detailed task of checking Cope's identifications and revising his classifications, which was to occupy him, along with many other matters, for the next thirty-odd years.

In this fortunate way also he began his acquaintance with the mammals of the Basal Eocene of New Mexico, revising the combined collections of Professor Cope and that which had recently been made by Dr. Wortman for the Museum. The year 1896–97 was thus devoted to "A

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[1] Gregory, William K 1930 William Diller Matthew, 1871–1930 Natural History, XXX, No 6, pp 664–666

Gregory, William K 1930 William Diller Matthew, Paleontologist (1871–1930) Science, LXXII No 1878, pp 642–645

Schuchert, Charles 1930 William Diller Matthew, February 19, 1871–September 24, 1930 Am Jour Sci, XX, December, 1930, pp 483–484

Osborn, Henry Fairfield 1931. William Diller Matthew, F R S Bull Geol Soc Amer (In press)

Revision of the Puerco Fauna,"[1] Matthew's first extensive paper on fossil mammals. In this he made certain definite contributions toward the solution of many of the major problems dealt with in his subsequent papers. In this paper he confirms Dr. Wortman's division into two well separated faunas, the Puerco and the Torrejon, which are shown to be as different as any two successive Eocene formations.

The most important and original parts of the paper are those that deal with the Creodonta, the Condylarthra and the Foot Structure of Basal Eocene Mammals. The creodonts were represented by five families, including the Oxyclænidæ, a group of genera with a remarkably primitive type of dentition, many of which had been placed among the Primates but which were now again referred to the Creodonta. To every one of these families Matthew later made important contributions, but in this paper only the initial steps were taken, by a careful revision of the genera and species. In discussing the Condylarthra of Cope, the important observation was made that this group of "protoungulates," as they had been called, is "nearly related to the early Creodonta and its hypothetical ancestral type or types would be strictly Creodont."

In the sections of the skeleton of *Euprotogonia* and on the Foot Structure of Basal Eocene Mammals it was pointed out that a review of the structure of the carpus and tarsus of Basal Eocene Primates, Creodonta, Condylarthra, Amblypoda, Edentata, did not support Professor Cope's view that in the primitive carpus and tarsus the proximal and distal rows of bones were arranged in vertical series like "unstruck bricks." On the contrary, "the conclusion to which the study of these feet leads, apart from any theoretical considerations, seems to me to be as follows:

"The primitive condition of the carpus was alternating, with the centrale present. By *absorption* of the centrale a serial carpus, except for the lunar-unciform contact, was produced. By fusion of the centrale with the scaphoid the alternating type of carpus would be maintained. That this primitive alternating carpus was preceded by an entirely serial carpus of the type of *Meniscotherium* is quite possible but there is no evidence of it.

"In the tarsus we find no evidence to support the theory of primitive serialism. Only in *Euprotogonia,* the most progressive of the group, do we find an approximately serial tarsus and this is accompanied by a slender foot adapted for running, and by reduced side toes. The drift of all the evidence is toward relegating the primitive serial carpus and tarsus back into the unknown Cretaceous."

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[1] 1897. Bull. Amer. Mus. Nat. Hist., IX, Art. XXII, pp. 259–323. 20 figs.

It may be noted that this virtual abandonment of Cope's theory of the origin of the ungulate carpus and tarsus if accepted would greatly weaken Cope's classification of the ungulate orders and his conclusions as to their relationships with each other and with the unguiculates. In the subsequent decades, as more and better preserved skeletons of Basal Eocene and Eocene mammals came to light, the correctness of Matthew's conclusion came to be fully realized by other palæontologists.

In 1898 his bibliography contains no entry, partly for the sufficient reason that the author was busy upon three important papers that appeared in 1899. In "A Provisional Classification of the Fresh-water Tertiary of the West"[1] the faunal lists of the successive horizons had been submitted to Professors Osborn, Cope, Scott and Dr. Wortman for approval or amendment and were based chiefly on Matthew's first-hand studies of the American Museum collections. A partial essay was made at a critical revision of the species. Thus was laid down the first extensive and critical basis for the expanded and revised lists of later years. Critical notes were also made on the so-called Lake Basins and Matthew's analysis of the later Tertiary horizons of the western states was given.

DEMOLITION OF THE "LAKE THEORY"

His second paper of the year 1899, "Is the White River Tertiary an Aeolian Formation?"[2] was a brilliant attempt to disprove the classical theory that the great fossil-mammal-bearing horizons of the western states were ancient "lake basins." By cumulative geologic and palæontologic evidence, this theory was shown to be untenable, while at the same time the author tried to establish the conclusion that at least the great bulk of the formations had been laid down as wind-blown loess on broad flood-plains or by rivers and streams. Soon afterward Hatcher, Osborn and others accepted at least the negative side of Matthew's paper but laid more stress on the periodic flooding of the "basins" by rivers.

"ANCESTRY OF THE CANIDÆ"

The third paper of 1899, "The Ancestry of Certain Members of the Canidæ, the Viverridæ and Procyonidæ,"[3] was published in collaboration with Dr. J. L. Wortman The sections by Matthew deal with the affinities of the Oligocene ('Miocene') Canidæ of North America and describe *Phlaocyon* as an ancestor of the Raccoons. Here, then, was the first of a series of papers on the ancestry of the Tertiary Carnivora, especially the Canidæ and Procyonidæ.

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[1] 1899 Bull. Amer. Mus. Nat Hist., XII, Art. III, pp. 19–75.

[2] 1899. Amer. Naturalist, XXXIII, No. 389, pp. 403–408.

[3] 1899. Bull. Amer. Mus. Nat. Hist., XII, Art. VI, pp. 109–139, Pl vi, 10 figs

OBSERVATIONS ON THE CREODONTS

In 1900 only one short article appeared, but in 1901 two important papers were issued. In "Additional Observations on the Creodonta," Dr. Matthew addressed himself with great success to the problem of clarifying the hitherto confused relationships and classification of the families of the Creodonta, a subject to which he returned at intervals in later papers. The puzzling characters of *Clænodon* of the Arctocyonidæ were carefully analyzed. It was shown (*op. cit*, p. 18) that "the Arctocyons were progressing towards the Bear line in all the most distinctive characters of both teeth and feet. But the wide gap between Lower Eocene and Middle Miocene makes any connection between the two somewhat uncertain. In the Canid line, on the other hand, we have a number of apparently intermediate stages known [leading from the dogs to the bears]. But these intermediate stages can not have been actually in the line of ascent, and even if they are unaltered descendants of more ancient types we still have a gap of some importance unbridged. The connection, moreover, is based on teeth alone. Professor Osborn, in discussing the evolution of the Mammalia remarks: 'The teeth and feet, owing to the frequent parallels of adaptation, may wholly mislead us if taken alone; when considered together they give us a sure key; for no case of exact parallelism in both teeth and feet between two unrelated types has yet been found or is likely to be' (Osborn, 1893, p. 10). If *Clænodon* be totally unrelated to the Ursidæ, it is an exception to this statement, and as far as I recall, the only one. And yet the evidence is very strong for deriving the Ursidæ from primitive Dogs." In later years Dr. Gidley again brought up the claims of *Clænodon* to be considered as possibly related to or near the line of ancestry of the bears but was vigorously opposed by Dr. Matthew.

"FOSSIL MAMMALS OF THE TERTIARY OF NORTHEASTERN COLORADO"

In the memoir entitled "Fossil Mammals of the Tertiary of Northeastern Colorado,"[1] the theory of lacustrine origin of the White River and Loup Fork groups was attacked in greater detail than in the brief article in the *American Naturalist*, and the theory of "flood-plain playa and æolian deposition" was defended with a wealth of arguments drawn from field observations and from an analysis of the faunas preserved in these formations. In the "Analyses and Discussion of the Faunæ," it was shown that "two distinct facies were presented by the fauna of each horizon [of the White River Oligocene], the characteristic fauna of the clays being widely different from that of the sandstones." The conclusion is reached (p. 371) that "the analogy of the clay fauna is with that of the modern plains, of the sandstone fauna with that of the modern forests (with some aquatic forms). In the clays we have hares, squirrels (cf. *Tamias*), vesper-mice and Ischyromids (cf. *Cynomys*) as the characteristic rodents; in the sandstones we have beavers. . . . " The analysis was continued throughout the fauna considered by orders and families. The general conclusion (p. 372) was as follows: "The above evidence seems to make it reasonably certain that the clays and sandstones contain respectively a plains and forest fauna, the latter including some aquatic types. And the occurrence of two such faunæ in these circumstances exactly accords with the theory of terrestrial and flood-plain origin of these beds as set forth in the previous section of this paper, while it seems utterly inexplicable on the theory of their lacustrine origin."

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[1] 1901, Mem Amer. Mus Nat Hist, I, pp 353–446, Pls xxxvii xxxix, 34 figs

From the section dealing with the systematic descriptions in this paper only two or three especially interesting items may be noted here. A carefully worked-out reconstruction of the skeleton of the primitive canid *Cynodictis gregarius* was given. This animal was so primitive that its skeleton as a whole was strikingly like that of a viverrine; with curved backbone, long tail, short spreading forefeet. In other words, it lacked the cursorial specializations of the later dogs.

Under the section dealing with the Felidæ, one finds a remarkably interesting discussion of the rise of the sabre-like canines of the Sabre-tooth. The idea that the tusks were used as stabbing weapons but used with the mouth closed was refuted by the fact that the special construction of the mandible permitted the jaw to drop even far below the level of the tips of the upper canines. Associated changes, especially in the size and position of the mastoid processes, indicate unusual strength in certain muscles involved in a stabbing movement of the head. The conclusion was reached that their prey consisted of "large short-necked animals, probably thick-skinned," and that "their most advantageous method of attack was to inflict stabbing and ripping cuts at points where an artery could be reached, using their short, broad and powerful forefeet as fulcrums, and probably bleeding the animal to death."

Passing to the Artiodactyla, the author gave an analysis of the Oreodonts (p. 395) from a combined evolutionary and taxonomic viewpoint. By examining his tables, etc., one may readily grasp not only the chief contrasts between the principal genera but the successive stages in the differentiation of the more specialized from the less specialized types. This was characteristic of Matthew that while scrupulously accurate as to facts he never lost the evolutionary and chronologic perspective and that he was never satisfied with merely recording differences but insisted on understanding their drift or meaning.

In the section on the Camelidæ the detailed description of new material is preceded by an analysis of the distinctive characters and of the genera and species of Loup Fork Camels. In the description of *Alticamelus*, the giraffe-camel, the following passage occurs: "The discovery of this specimen introduces to science one of the most interesting instances of convergence yet observed. The effect of extreme height, in order to enable the animal to feed upon the inaccessible foliage of high and thorny shrubs, is obtained in this species, as in the giraffe, by the elongation of the neck vertebræ and the legs. But the giraffe is derived from the early antelopes and *Alticamelus* from early camels and the difference of origin has caused the attainment of the desired result in a somewhat different manner." The subsequent analysis of the osteologic resemblances and differences between the giraffe-camel and the giraffe is full of meaning and value.

In the next year (1902) eight rather brief papers appear in his bibliography, each embodying some record of his activities either in preparing for exhibition the hall of vertebrates in the Museum or in describing material collected by himself and his colleagues during the field parties in Texas, Colorado and elsewhere. Of these, the article entitled "New Canidæ from the Miocene of Colorado"[1] is of special interest because it contains the first outline of his theory of the Holarctic origin and dispersal of the principal families of placental mammals, under the control of secular climatic changes.

Thus by the close of his first five years at the Museum we find that he had already begun to deal in a very constructive way with most of the great problems that continued to engage his energetic interest for the rest of his life. In reading any of his earlier papers one gets the impression that only in a few places could they be considered as superseded or out of date a quarter of a century later, even where much more complete material has since been discovered. This is perhaps because he combined high originality and initiative with a great reserve of conservatism and caution.

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[1] 1902, Bull. Amer. Mus. Nat. Hist., XVI, Art. XXI, pp. 281-290.

MEMOIR ON THE CARNIVORA AND INSECTIVORA OF THE BRIDGER BASIN

At this point it appears advisable, however, to abandon a chronologic review of his many important publications and to attempt brief summaries in a number of different fields.

In his subsequent contributions on the Creodonta, he described many new species, and by means of more and better material was able to settle many questions left open in previous papers. His classification of the group was given in the Memoir on "The Carnivora and Insectivora of the Bridger Basin, Middle Eocene" (1909),[1] and in "A Revision of the Lower Eocene Wasatch and Wind River Faunas" (1915).[2] Following Cope, Matthew defined the suborder Creodonta as distinguished from the Fissipedia by such primitive characters as the small simple brain, the separate scaphoid, lunar and centrale, the flat astragalar trochlea, the presence of five digits on the manus and pes (except in more advanced forms), the retention of an entepicondylar foramen on the humerus and of a third trochanter on the femur.

At first Matthew accepted the grouping by earlier authors into Adaptive and Inadaptive sections of the Creodonts, adding thereto a third section, Primitive·Creodonts, to contain the Oxyclænidæ, whose status as creodonts he had been able to confirm. Later he invented the highly useful terms, Procreodi, Acreodi, Pseudocreodi and Eucreodi, which were given in reference to the contrasting characters of the shearing teeth in the different families. In the primitive Oxyclænidæ the shearing function was not yet concentrated on any of the cheek teeth, and they were therefore named Procreodi. To this division the Arctocyonidæ were transferred in 1915, as a result of the discovery of the Lower Eocene genus *Thryptacodon* of Matthew, which clearly tended to connect the Arctocyonidæ with the more primitive family of Oxyclænidæ. In the Eucreodi, including only the Eocene family of the Miacidæ, the specialized carnassial function was confined to the fourth upper premolar and the first lower molar exactly as in the modern Fissipedia. In the Pseudocreodi, very similar appearing carnassial teeth were developed not on

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[1] 1909. Mem. Amer. Mus. Nat. Hist., IX, Pt. VI, pp. 291–567, Pls. XLII–LI, 118 figs.

[2] 1915. (With Walter Granger.) Part I (By W. D. Matthew): Order Feræ (Carnivora), Suborder Creodonta. Bull. Amer. Mus. Nat. Hist., XXXIV, Art. I, pp. 1–103. Part II (By W. D. Matthew): Order Condylarthra, Family Hyopsodontidæ. *Idem*, XXXIV, Art. IX, pp. 311–328. Part IV (By W. D. Matthew): Entelonychia, Primates, Insectivora (part). *Idem*, XXXIV, Art. XIV, pp. 429–483.

p^4 and m_1 but on one or another of the true molars (on m^1 and m_2 in the Oxyænidæ and on m^2 and m_3 in the Hyænodontidæ). In the Acreodi, including the Mesonychidæ and the related family of Triisodontidæ, there were no carnassials. The characters of the ungual phalanges, whether unfissured or fissured or flattened, were also used in this primary division.

Matthew retained the Eucreodi in the suborder Creodonta, partly because Cope, in his definition of the suborder, had included representatives of both the divisions afterward called Inadaptive and Adaptive Creodonts and because he (Matthew) was indisposed to follow to extremes either the group or the linear theory of classification and regarded a combination of the two as more practical and convenient and as best expressing the relationships of groups from both the morphological and phyletic standpoints. "As regards the Eocene Carnivora," he continues (1909, p. 320), "it appears better to retain the generally accepted arrangement as more natural and convenient. They form a natural and readily definable suborder, divisible into three groups of about equal value, besides a few primitive forms of uncertain affinities. One of these groups gave rise to the Fissipedia by assumption of a number of progressive characters; the others became extinct without assuming these progressive characters. The conversion of the adaptive Creodonts into Fissipedia and the disappearance of the inadaptive groups nearly coincide with the end of the Eocene. If on the other hand we place the Adaptive Creodonts in the Fissipedia, we not only remove them from their nearest relatives and make it difficult to adequately define the inadaptive groups so as to exclude them, but we obscure, as it seems to me, the real relationships of the Eocene Carnivora to each other and to adjoining orders, as well as to the more modernized group. The attempt to distribute the adaptive genera into the modern families is open to more serious objections, as even with a complete knowledge of the skeleton it is not always possible to be sure of their exact relationship to the living carnivora, and to associate the closely allied Eocene genera with the widely separated modern families to which they may be ancestral, not only obscures their real relations, but makes their position dependent upon very transitory and uncertain theories of phylogeny."

As regards the origin of the Fissipedia, Matthew suggested in the same memoir (1909, p. 351) that "it appears probable that in the Miacinæ and Viverravinæ we have the beginning of the differentiation into Arctoid and Aeluroid carnivora. . . . "

The phylogeny of the bears continued to offer difficulties at this time (p. 351) but as the years passed and he saw more and more of both dogs and bears as well as of alleged intermediate genera, he became firmly convinced that the bears had been derived from dogs of some sort.

In this memoir (1909), Matthew dealt rather fully and incisively (pp. 335–339) with Dr. Wortman's idea that the Fissipedia, Creodonta and Insectivora are independently derived from the Upper Cretaceous marsupials as exemplified by the Laramie genus *Didelphops*, citing very strong adverse evidence against this view and defending the contrary thesis that the Creodonta and all other placentals are separated from the carnivorous marsupials "by numerous and important distinctions which bespeak a very remote relationship between the Marsupials and the Eutherian groups."

One of the most important sections of the Memoir on the Bridger Carnivora and Insectivora was that which dealt with the stratigraphy and faunal divisions of the Bridger formation. This extensive palæontological and geological survey had been made for the U. S. Geological Survey by Matthew and Granger during the seasons of 1902 and 1904, in determining faunal levels in the Bridger formation, under instructions from Professor Osborn and in connection with the latter's investigations on the phylogeny of the titanotheres. They were able to establish the existence of five successive major faunal levels containing numerous subdivisions and recognizable at many different localities in the Bridger basin.

On the basis of the faunal lists recording the precise level of each species, Matthew distinguished the Lower from the Upper Bridger and was able in the case of a number of species to trace the changes in the premolar and molar teeth as one passed from the lower to higher levels. This was especially well shown in the study of nearly three hundred specimens of the genus *Hyopsodus* from successive levels in the Bridger basin. This genus was provisionally referred to the order Insectivora, the latter being taken in a very broad sense. The opinion was expressed, however (p. 512), that "its affinities are in reality closer to the Condylarthra than to the more typical Insectivora," and later the discovery of better skeletal material confirmed this view, so that the family Hyopsodontidæ was transferred to the Condylarthra as a very primitive division of that order. Another puzzling form, provisionally classed as an insectivore, was the genus *Pantolestes*, which was shown to possess indications of aquatic habits in several parts of the skeleton.

In short, this memoir abounds in important and far-reaching facts, analyses and conclusions. We may cite, for instance, the provisional phylogenies of the Miacidæ (p. 353) and Hyænodontidæ (p. 467), the author's comparative drawings illustrating the dentitions of carnivores of the different families, his studies on the basicranial region and dental foramina of carnivores and insectivores, his demonstration (p. 430) of the progressive lengthening of the metatarsal and first phalanx as compared with the length of the femur in aquatic as contrasted with terrestrial carnivores, his remarks (p. 549) on the value of the astragalus in Ordinal Classification. It is greatly to be regretted that this fundamental work has so long remained hidden among thousands of no less detailed but far less important technical papers and that so little of the material in it has found its way into text-books and general works on vertebrate palæontology and mammalogy.

LATER WORK ON CARNIVORA

Matthew continued at intervals to contribute to the history of the Canidæ and Mustelidæ. Recently (1929) his views on the phylogeny of the Canidæ and on the origin of the bears from a branch of the Canidæ were set forth in an important article in the *Journal of Mammalogy*.[1]

Of his subsequent contributions to the Insectivora the most important was his paper of 1913 on "A Zalambdodont Insectivore from the Basal Eocene."[2] Here he was able to show, first, that the zalambdodont insectivores, like so many groups, conformed to the rule of Holarctic origin and of dispersal into more southern latitudes, the most primitive known forms being found in the Basal Eocene, Eocene and Oligocene of North America, their present-day relatives being found in Madagascar, South Africa and West Africa. The important skull which was the subject of the 1915 paper also enabled him to adduce strong evidence that the peculiar zalambdodont type of upper molar had been derived from a more normal tritubercular type by the inward displacement of the conjoined para- and metacones and by the progressive reduction of the internal cusp.

LATER WORK ON INSECTIVORA

Other important papers dealing with the Insectivora are to be found in "A Revision of the Lower Eocene Wasatch and Wind River Faunas" (with Walter Granger) (1915, 1918),[3] and various shorter papers on new fossil zalambdodonts (1903, 1910), leptictids and erinaceids (1903, 1928, 1929), plesiadapids (*Nothodectes*, 1917, *Stehlinius*, 1921). These groups were also dealt with in "Climate and Evolution" (pp. 224–227).

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[1] 1929. The Phylogeny of Dogs. Journ. Mammalogy, XI, No. 2, pp. 117–138, 3 figs.

[2] 1913. Bull. Amer. Mus. Nat. Hist , XXXII, Art. XVII, pp. 307–314, Pls. LX, LXI.

[3] 1918. Part V (By W. D. Matthew). Insectivora (continued), Glires, Edentata. Bull. Amer. Mus. Nat. Hist., XXXVIII, Art. XVI, pp. 565–657.

To Matthew the order Insectivora was a "generalized and broadly inclusive order" (in contrast with a more compact specialized order such as the Primates) (1918, p. 568), containing various groups that were unknown descendants of primitive Mesozoic placental insectivores, but which apart from this were not closely related to each other. To this broad assemblage he referred not only the true insectivores, including the zalambdodonts, the leptictids and erinaceids, the talpids, soricids and nesophontids, but also such very diverse forms as (a) the Eocene *Pantolestes* and *Palæosinopa,* having creodont-like teeth but more insectivore-like astragalus; (b) *Apheliscus,* with more tubercular molar teeth and long slender jaw—one of the most puzzling of all these "insectivores"; (c) *Plagiomene* (1918, p. 600), with dilambdodont teeth suggesting those of *Galeopithecus;* (d) *Nyctitherium* (1918, p. 603), with teeth and limb bones suggestive of Chiroptera but provisionally left in the Soricoidea; (e) the Mixodectidæ (1915, pp. 465–467) regarded as possibly allied with the Eocene Tarsiidæ but provisionally left in the Insectivora; (f) the Plesiadapidæ (including *Nothodectes* ([=*Plesiadapis*]), the "Apatemyidæ," etc.), regarded (1928, p. 957) as "semi-Primates"[1] (Menotyphla), with enlarged, somewhat rodent-like incisors; (g) the Basal Eocene *Onychodectes* and *Conoryctes,* "transitional in some ways to Tæniodonta." The Lower Eocene *Creotarsus* (1918, p. 611) was placed after the Insectivora under "Order and Affinities Uncertain," since, although its lower teeth showed some resemblances to those of primitive artiodactyls and others to insectivores, its astragalus approximated certain of the creodont types.

Many of these forms differ so widely from the typical insectivores in the dentition that most authorities would have referred the different families to different orders. But Matthew considered the evidence insufficient for placing them in any other given order, and as noted above he held the "Insectivora" as a convenient broad central group. In these doubtful cases he gave less weight to resemblances and differences in the dentition than to the characters of the astragalus, which he regarded as a more constant and sure indicator of ordinal affinities. In his 1928 paper on "The Evolution of the Mammals in the Eocene," he placed (p. 975) the *Plesiadapis* group under the "Order Menotyphla," as "semi-Primates" (p. 957) intermediate in some respects between Insectivora (in the restricted sense) and Primates. His final review of these difficult but important problems connected with the Eocene insectivorous groups, which will appear in his forthcoming memoir on the Paleocene mammals (Mem. Amer. Mus. Nat. Hist., 1931), will be awaited with a melancholy interest.

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[1] 1928 The Evolution of the Mammals in the Eocene, Proc. Zool. Soc. London, Pt. 4, 1927. [Published Jan. 12, 1928.] Pp 917–985, 16 text-figs.

EODELPHIS, A CRETACEOUS MARSUPIAL

Another group of primitive mammals to which Matthew made an outstanding contribution was that of the polyprotodont marsupials. In his paper on "A Marsupial from the Belly River Cretaceous. With Critical Observations upon the Affinities of the Cretaceous Mammals" (1916)[1], he described the lower jaw and parts of a skull of a small mammal which had been found by Barnum Brown on Red Deer River, Alberta, embedded beneath a ceratopsian dinosaur skull in a formation of unquestionably Upper Cretaceous age. This jaw and parts of the skull resembled those of a modern opossum in so many points that its relationships with the American polyprotodont marsupials (Didelphiidæ) could not be doubted. This fortunate discovery enabled Matthew to clear up the relationship of Cope's *Thlæodon*, which was now shown to be a polyprotodont marsupial with thickened tubercular cusps on its upper cheek teeth. The presence of ancestral opossums in the Cretaceous went far to confirm the views of Huxley, Dollo and Bensley that this family was practically ancestral to the more specialized marsupials of Australia and South America; and at the same time it gave additional evidence in favor of Matthew's view of the early Holarctic origin of many groups now confined to tropical or southern latitudes.

FOSSIL RODENTS

The fossil rodents of North America also claimed their share of Dr. Matthew's attention. He dealt with them incidentally in various faunal papers, but his most important work on this subject was that "On the Osteology and Relationships of *Paramys* and the Affinities of the Ischyromyidæ" (1910).[2] Here practically complete skeletons of the Eocene rodent *Paramys* were described and beautifully figured, together with skulls, dentitions, etc., of other Eocene and Oligocene rodents. So far as their dentition and the majority of their skeletal characters were concerned, *Paramys* showed strong evidence of relationships with modern rodents, especially the sciuromorphs, while the other genera were evidently more or less closely related to it. But in all these Eocene forms the insertion of the anterior superficial branch of the masseter muscle was evidently beneath the anterior rim of the malar instead of in front of the orbit, as in modern sciuromorphs. To Matthew this meant simply that *Paramys* and its allies had retained the more primitive conditions which had been lost by the later sciuromorphs, but Messrs. Miller and Gidley broke up the Ischyromyidæ into several families and referred them to different superfamily divisions of the rodent order.

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[1] 1916. Bull. Amer. Mus. Nat. Hist., XXXV, Art. XXV, pp. 477–500, Pls. II–IV, 4 figs.
[2] 1910. Bull. Amer. Mus. Nat. Hist., XXVIII, Art. VI, pp. 43–71.

FOSSIL PRIMATES

The Lower and Middle Eocene Primates of North America were revised by Matthew in 1915;[1] he was able to revise, confirm and considerably extend the previous reviews by Osborn (1902) and by Wortman (1904), and to add several new species of notharctids and "anaptomorphids." He was also able to trace, more closely than had hitherto been done, the transformation of the very simple triangular and tritubercular upper molar of the older species of *Pelycodus*, through a series of successive horizons, into the quadrate and quadritubercular molar of *Notharctus*. The discovery of good skeletal material of *Notharctus* enabled him to refer it definitely to the suborder Lemuroidea, in spite of the fact that *Notharctus* itself never assumed the specialized dentition of the modern *Lemur*.

Among the Eocene Tarsiidæ, he gave an excellent key for the distinction of the various genera and species and a carefully corrected reconstruction of the famous skull called by Cope "*Anaptomorphus homunculus*," but showed that the name *Anaptomorphus* belonged properly to another genus based on a lower jaw with two lower incisors instead of one; he therefore referred *Anaptomorphus homunculus* to a new genus, *Tetonius*, related to *Absarokius* and more distantly to *Uintanius*, *Shoshonius*, etc

While he had less occasion for intensive study of the higher Primates, including man, Dr. Matthew took a keen interest in their evolution, of which he gave an admirable critical summary in his "Outline and General Principles of the History of Life" (1928, pp. 211–236).[2]

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[1] 1915 A Revision of the Lower Eocene Wasatch and Wind River Faunas (with Walter Granger) Part IV (by W D Matthew) Entelonychia, Primates, Insectivora (part) Bull Amer Mus. Nat. Hist, XXXIV, Art XIV, pp 429–483

[2] 1928 Synopsis of Lectures in Paleontology I Univ of Calif Syllabus Series, Syllabus No 213, pp. 1–253

EDENTATES

The Edentates naturally received considerable attention from Dr. Matthew, who had occasion to study especially the ground sloths of the Cope Pampæan collection, the edentates collected by Barnum Brown in Patagonia, and the Tæniodonts and Palæanodonts of the Basal and Lower Eocene. "The Ancestry of the Edentates"[1] was treated in an illuminating way in a brief, semi-popular article in 1912, in which the mounted skeleton of *Hapalops*, an ancestor of the ground sloths from the Patagonian Miocene, was fully described. The Palæanodonta were named by Matthew (in 1918)[2] as a suborder of Edentata, to include the Metacheiromyidæ of Wortman, which were at first referred by the latter to the cheiromyoid division of the Primates. *Metacheiromys* had been redescribed from better material by Osborn, who had referred to it as "An Armadillo from the Middle Eocene (Bridger) of North America." Matthew's *Palæanodon ignavus* was based on a skull, vertebræ, foot-bones, etc., from the Lower Eocene (Wasatch) of Wyoming. This skeleton was shown to be closely related to the Bridger *Metacheiromys* but more primitive in several respects. A careful consideration of the characters and affinities of *Palæanodon* and *Metacheiromys*, in comparison with armadillos and other Xenarthra, with *Manis* and *Orycteropus* and their supposed relatives in the Tertiary of Europe, led Matthew to the conclusion (p. 652) that *Palæanodon* is related to the armadillos, although it retains numerous primitive characters that have been lost in varying degree by the late Tertiary and modern genera and has not developed certain obviously specialized characteristics of all the South American edentates (Xenarthra). Nevertheless, for geographic and faunal reasons (p. 653), he did not think that *Palæanodon* itself was directly ancestral to the Xenarthra but rather that the Xenarthra and *Palæanodon* had been derived from some late Cretacic fauna unknown to us but presumably inhabiting some part of North America which had also contained the immediate ancestors of our Paleocene and Lower Eocene Condylarthra, Taligrada, marsupials, edentates, etc. Comparison with *Manis* and with the supposed edentate remains of the Oligocene and Miocene of France and Germany led him to conclude (p. 654) that: "On the whole, I can find no very conclusive evidence against deriving *Manis* as well as the Loricata (and through them the remaining Xenarthra) from the primitive type represented by *Palæanodon*. Just how direct the ancestors may be in each case is a highly speculative matter. But I think that we are well warranted in concluding that there is, after all, a real affinity between the Pholidota and Xenarthra. They may not necessarily be included in a single order but they do clearly belong in the same natural superorder Edentata.

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[1] 1912. Amer. Mus. Journ., XII, No. 8, pp. 300–303.

[2] 1918. A Revision of the Lower Eocene Wasatch and Wind River Faunas (with Walter Granger). Part V (by W. D. Matthew): Insectivora (continued), Glires, Edentata. Bull. Amer. Mus. Nat. Hist., XXXVIII, Art. XVI, pp. 565–657.

"*Orycteropus*, however, does not belong in this natural group. So far as I am able to judge, it has no particular relations to the edentate-insectivore group, but is descended rather from the creodont-condylarth group of the primitive placentals. I can find nothing in the skull or skeleton that seems to be characteristically edentate, as distinguished from merely primitive. . . . Elliot Smith believes that the brain indicates affinities rather with the primitive ungulates than with unguiculates; and there is some support for this view in the skeleton, at least so far as condylarthran affinities are suggested. The astragalus has some resemblance to that of typotheres and some other notoungulates, which would be in accord with this derivation."

FOSSIL AND RECENT UNGULATES

Dr. Matthew's contributions to knowledge of the fossil ungulates were numerous and fundamental. His early studies (1897, pp. 299–311, 320, 321) on the skeleton of *Euprotogonia*, from the Torrejon, abound in observations of great interest and value. He remarked that "in every detail of its skeletal structure this relatively primitive condylarth shows a most striking resemblance to the Creodonts. The customary bend of the knee and elbow, the long heavy tail, the semiplantigrade five-toed foot are general points of likeness, and when we compare the separate limb-bones, the close relationship becomes apparent, especially close to the primitive types. . . . In every point where *Euprotogonia* differs from *Phenacodus*, it approaches the Creodonts—or rather approaches that hypothetical form from which descended both Creodonts and Condylarths. It stands therefore in a strictly intermediate position." While Cope had supposed that the Lower Eocene *Phenacodus* was the "five-toed ancestor of the horse," Matthew concluded (p. 309) that "*Euprotogonia* stands nearer to the early Horses than does *Phenacodus*, but I do not think that it can be considered the direct ancestor of *Hyracotherium*. . . . the skeleton exhibits no indications of an advance from the primitive type toward *Hyracotherium* in particular while it has many points of resemblance to *Phenacodus*. We must go somewhat lower down than the Torrejon to find the junction of the Equine and Phenacodont phylæ. . . . it must be supposed that their common ancestor was a clawed animal, for *Euprotogonia* is in the first stage of development as a hoofed mammal, and shows very little else of the ungulate type of skeleton. In the Torrejon representatives of the horse family, one would expect to find the molars showing some trace of approaching lophodonty, the last one of full size and the astragalus with some indications of a perissodactyl development. In most other respects it might well approximate *Euprotogonia.*" While this prophecy even yet remains unfulfilled, the reviewer has entire faith in its truth.

It has been noted above (p. 2) that in the same memorable paper Matthew discredited Professor Cope's theory that the "serial" carpus of *Phenacodus* was primitive, by showing (a) that in *Euprotogonia,* the direct ancestor of *Phenacodus,* the carpus was not "serial" but "alternating"; (b) that it was alternating in the primitive creodonts and periptichids; (c) that an alternating type could be converted either into a serial type by absorption of the centrale carpi or into a displaced type by fusion of the centrale with the scaphoid.

In his "Memoir on the Bridger Carnivora and Insectivora" (1909), already noted, Matthew gave a very full description of the skull and dentition of *Hyopsodus.* Earlier authors had classed these small animals with the Primates because of the general resemblance of their molar teeth to those of *Notharctus.* Wortman had removed them from the Primates to the Insectivora. Matthew in 1909 allowed the family to remain in that order, although expressing the opinion (p. 512) that "its affinities are in reality closer to the Condylarthra than to the more typical Insectivora." In 1915 (p. 312)[1] he states that "additional skeletal material of *Hyopsodus,* including a well preserved hind foot, served to confirm the above somewhat tentative conclusion and made it advisable to remove the family to the Condylarthra. Its position in the Insectivora has always been anomalous and could only be defended by regarding this order as a sort of catch-basket for primitive unspecialized placentals that could not be placed elsewhere. . . The astragalus, while very primitive, is distinctly of the type peculiar to primitive Carnivora and Condylarthra, as opposed to the characteristic form of the Insectivora or that of the primitive Primates. The teeth exclude it from the Creodonta. In teeth, skull and skeleton characters it compares best with the most primitive among the Condylarthra, and the ungual phalanges, while they are claws rather than hoofs, are but little different from those of

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[1] 1915. A Revision of the Lower Eocene Wasatch and Wind River Faunas (with Walter Granger). Part II (by W. D. Matthew): Order Condylarthra, Family Hyopsodontidæ. Bull. Amer. Mus. Nat. Hist., XXXIV, Art. IX, pp. 311–328.

Tetraclænodon. . . . " He then gave a much fuller and more satisfactory definition of the order Condylarthra and of the five families which he finally included in it, namely, Mioclænidæ, Hyopsodontidæ, Phenacodontidæ, Meniscotheriidæ, Pleuraspidotheriidæ

In his "Revision of the Puerco Fauna" (1897) Matthew had remarked that Cope's order Condylarthra, as including the three families Phenacodontidæ, Periptychidæ and Meniscotheriidæ, together with the Mioclænidæ (which had been referred to the order by Osborn and Earle), "does not form a genetic line as do the divisions of the more advanced forms but represents the first stage of ungulate evolution. . . . The Condylarthra . . . do not form a homogeneous suborder. Its members had diverged more than they had progressed." Osborn had removed *Pantolambda* and the Periptychidæ to the Amblypoda. But Matthew, troubled by the intermediate characters of the *Anisonchus* group between *Periptychus* and *Euprotogonia*, left them all in the Condylarthra, where Cope had placed them, although admitting that *Pantolambda* showed an evident relationship to *Coryphodon* of the Wasatch in the teeth, and to a less extent in skeletal structure. Later he referred the Periptychidæ and Pantolambdidæ to the "order Taligrada"; in 1927 (1928, p. 948) his diagram shows the Taligrada connected with the Amblypoda, although nominally a distinct order. In this recent paper (p. 968) he showed that so far as regards the patterns of the upper molar teeth, the Amblypoda included two very distinct divisions: the first comprising the Paleocene *Pantolambda*, the Lower Eocene *Coryphodon* and the Upper Eocene Mongolian *Eudinoceras*, the second including the Paleocene *Prodinoceras*, the Lower Eocene *Bathyopsis*, the Middle Eocene *Uintatherium* and the Upper Eocene *Eobasileus*. The discovery of *Prodinoceras* showed that the attempts to derive the *Uintatherium* type of molars from those of *Coryphodon* had been in vain and that the two divisions of the Amblypoda were already widely different from each other in the Paleocene.

Matthew's contributions to the phylogeny of the Artiodactyla were many and varied, too much so, in fact, to be noticed in detail in this all too brief outline of his principal results. He dealt in numerous papers with the camels, oreodonts, hypertragulids, cervids, giraffes, antilocaprids, antelopes, cattle, etc., of the ruminant series, as well as with the anthracotheres and dicotylids of the suillines. In his final diagram of the "phylogeny of the Artiodactyla," his summary of the actual palæontological succession and of the relationships of the modern families to their Eocene and Paleocene forerunners are clearly set forth. In one of his latest papers, published June 30, 1929, he gives an admirably clear and practicable "Reclassification of the Artiodactyl Families"[1] into five major groups, as follows: Palæodonta, or primitive Bunodonts, including the American Eocene dichobunids and the Upper Eocene to Miocene Entelodonts; Hyodonta, or pig-like bunodonts, including the pigs, peccaries and hippopotami; Ancodonta, or primitive tetradactyl Selenodonts, a large group including the old bunoselenodonts, the Cænotheriidæ and Oreodontidæ, with the four-toed short feet of the pig group but with partly or wholly selenodont molars; Tylopoda, or Camel group, including the Xiphodonts and camels; Pecora, or true Ruminant group, including the tragulids, cervids, giraffids, antilocaprids and bovids.

As a result of systematic collecting continued year after year, the American Museum of Natural History amassed an enormous collection of fossil Equidæ throughout the long series of Tertiary and Quaternary horizons. Dr. Matthew intensively studied thousands of teeth and skeletal parts of fossil Equidæ, not only while identifying and cataloguing the collections but especially in preparing his various faunal papers, including the "Third Contribution to the Snake Creek Fauna" (1924).[2] With reference to the collection of fossil Equidæ from the Snake Creek quarries in Western Nebraska, he wrote (*op. cit.*, p. 154): "This represents many thousands of individuals, no two of them exactly alike in the complex details of tooth construction. If the standards of species distinction that have been accepted by most American students of fossil Equidæ were applied conscientiously to this great collection, the result would be to place upon record scores if not hundreds of 'new species' from this one locality. But the thousands of isolated teeth or other fragmentary specimens would clearly show that there are no really constant and uniformly associated distinctions between such 'species.' They are mainly individual differences. . . . " Again, in discussing the relationship of *Pliohippus* to *Equus* and *Hippidium,* he writes as follows:

"I believe, however, that the hard and fast lines of distinction that it is customary among palæontologists (and zoologists) to draw between 'species' are not justified by the evidence; that when one deals with very extensive series of specimens from many closely succeeding stages and many localities, the amount and character of intergrading and mixture of their species characteristics is only explicable as the result of continual admixture of numerous interbreeding strains, so that the 'species' is merely a more or less arbitrary selection of material representing approximations to a strain locally and temporarily dominant. It is to be pointed out in this connection that interbreeding does not produce exact intergradation in the characters of a series of specimens but various admixtures of more or less distinct and definite characters. . . . From this viewpoint the more detailed affinities of the later Equidæ are matters of degree of relationship or dominance of one or another ancestral stock in a complexity of intercrossing strains which only slowly and gradually take on that complete infertility between progressively diverging groups which brings about definite and permanent distinctness." In his application of this theory to the origin of the modern *Equus*, he suggested (p. 168) that "*Equus* shows an admixture, somewhat varying in its different species, of progressive characters, some of which are assumed earlier by typical Pliohippi, some by typical Hipparions; there is nothing in the generic characters of either genus to exclude it from the ancestry of *Equus* but all the better-known species of each are off the direct line, although some are perhaps not excluded from participation in some degree in the ancestry of the modern horses."

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[1] 1929. Bull. Geol. Soc Amer., 40, pp. 403–408.
[2] 1924. Bull. Amer. Mus Nat. Hist., L, Art. XI, pp. 59–210.

In view of all this it was a matter of considerable interest that soon afterward (1924) Dr. Matthew and his assistant George Gaylord Simpson found in the Blanco (Middle Pliocene) formation of Texas two skeletons of a fossil equine which proved to be intermediate in character between *Pliohippus* and *Equus*. This stage of evolution was accordingly named by Matthew, *Plesippus* (near horse.)[1]

As a result of his great mass of detailed knowledge of the fossil Equidæ, Dr. Matthew was able to prepare an excellent handbook on the Evolution of the Horse and an authoritative and critical review of the same subject, published in the *Quarterly Review of Biology*, 1926, with many beautiful illustrations and diagrams. The same article also contains his diagram showing the divergent evolution of the perissodactyls in the older Tertiary, which summed up the results, primarily of his own studies but with due regard to the views of other authorities, on the phylogeny of the numerous families and subfamilies of rhinoceroses, lophiodonts, tapirs, horses and other perissodactyls.

VARIOUS FAUNAL PAPERS

Concerning Matthew's later papers on fossil mammalian faunæ, especially those of the Miocene and Pliocene of the western states, India and Mongolia, one can only say in a word that they record thousands of facts that are important to specialists and that they abound in discussions and views of wider interest. For example, in his review of the Siwaliks fauna[1] as a result of his studies in the Indian and British Museums, he made scores of important observations on the phylogeny of the bears, giraffes, camels and other groups and gave new evidence as to the correlation of the Siwalik horizons with those of the late Tertiary and Pleistocene of Europe and North America.

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[1] 1924. A New Link in the Ancestry of the Horse Amer. Mus. Novitates, No 131, Sept. 23, 1924, pp 1, 2.

Similarly in his various brief articles on the fossil mammals of Mongolia and China, as a result of his own and of his colleagues' field observations and Museum studies, he was able to determine not only the relationships of the mammals but also the approximate positions of the faunæ, in comparison with the better known faunæ of Europe, India, North and South America.

In connection with South American palæontology he described (1915, pp. 429–433)[2] a curious little lower jaw from the Lower Eocene Wasatch of Wyoming, which he referred to the notoungulate order of Entelonychia. He pointed out that the molar teeth of this form resembled those of the Patagonian *Notostylops* and related types in general pattern and in the possession of certain features peculiar to the notoungulates. He thought it improbable that these resemblances could be due to convergence and therefore regarded the new form *Arctostylops* as probably an aberrant offshoot from the northern ancestors of the extinct South American ungulates. It was therefore a matter of great interest that one of the Museum expeditions in Mongolia discovered there in a formation of possibly Paleocene age a diminutive lower jaw, together with the upper teeth of a mammal of the notoungulate type, that closely resembled *Arctostylops*.[3] Here, then, was direct evidence for the view so long advocated by Matthew upon other grounds, namely, that the peculiar extinct South American orders had sprung from some very early immigrant from northern North America, which in turn had been derived from north Asiatic ancestors.

GENERAL THEORIES

In conclusion, we come to the more general theories of mammalian origin and dispersal for which Dr. Matthew was far more widely known than for his detailed technical monographs, although the latter must

[1] 1929. Critical Observations upon Siwalik Mammals (Exclusive of Proboscidea). Bull. Amer. Mus. Nat. Hist., LVI, Art. VII, pp. 437–560.

[2] 1915. A Revision of the Lower Eocene Wasatch and Wind River Faunas (with Walter Granger). Part IV (by W. D. Matthew): Entelonychia, Primates, Insectivora (part). Bull. Amer. Mus. Nat. Hist., XXXIV, Art. XIV, pp. 429–483.

[3] 1929. Additions to the Fauna of the Gashato Formation of Mongolia. (With Walter Granger and George Gaylord Simpson). Amer. Mus. Novitates, No. 376, Oct. 7, 1929, pp. 1–12.

always be regarded by active students of fossil mammals as of far greater importance and value. The first was his theory of the arboreal origin of the Mammalia, which was set forth in a brief article in the *American Naturalist* in 1904.[1] Here he noted that, while Huxley, Dollo and Bensley had adduced strong evidence for the arboreal origin of the marsupials, he had for some time been of the opinion that this was true not only of the marsupials but of the placentals as well. In support of this view he cited various skeletal characters of the oldest creodonts, protoungulates, rodents, primates, etc., which appeared consistent with the hypothesis that they were either semiarboreal to arboreal or had been derived from arboreal Mesozoic mammals. He then reviewed the vertebrate faunæ and life zones of the later Mesozoic era, suggesting that while the giant reptiles for the most part held the terrestrial field, the mammals had remained as small forest-living, arboreal or semiarboreal forms, but that with the great climatic changes at the close of the Mesozoic and the consequent spread of upland conditions, the mammals had abandoned their arboreal habitat and exploited the areas left more or less vacant by the giant reptiles. Against this theory Dr. Gidley[2] later brought the objection that certain of the characters cited for arboreal ancestry by Matthew (such as the five-toed spreading hands and feet, long tail) might be merely primitive characters inherited from reptilian ancestors. But to the reviewer it seems that the resemblances of the Paleocene mammals to the reptiles are only very distant and general ones, while their resemblances to the arboreal opossum are much more specific, though their former arboreal adaptations even in the Paleocene, had already undergone considerable reduction in response to the various terrestrial adaptations which they were then assuming.

By far the most famous of Dr. Matthew's works was his "Climate and Evolution" (1915).[3] His main theses were: (a) the relative permanency of the great ocean basins, as a result of isostatic relations of water and land masses; (b) the origin of most of the orders and families of mammals in Holarctic areas and the subsequent spreading of many of them into southern latitudes; (c) the deployment in the southern countries of the descendants of immigrants from the north, into new faunæ like those of the marsupials of Australia or the extinct notoungulates of South America; (d) the importance of geographic isolation in protecting the descendants of archaic stocks from the destructive competition of the higher placental orders; (e) the impelling force of secular climatic changes, such as the great lowering of temperatures at the various periods from the Permian onward, in causing increased severity of Natural Selection for higher body temperature, for larger and better brains and other superior adaptations against extremes of heat and cold.

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[1] 1904 The Arboreal Ancestry of the Mammalia. Amer. Naturalist, XXXVIII, pp. 811–818.

[2] 1923 Paleocene Primates of the Fort Union, with Discussion of Relationships of Eocene Primates. Proc. U. S. Nat. Mus., LXIII, Art. 1, pp. 10–38, Pls. i–v.

[3] 1915 Ann. N. Y. Acad. Sci., XXIV, pp. 171–318, 33 text figs.

In connection with this general theory, Dr. Matthew vigorously opposed the hypothetical building of great "land bridges" across wide ocean spaces to account for similarities between animals and plants on opposite shores of the oceans. He was able to adduce evidence, for example, that such forms as the extinct chrysochlorid-like *Necrolestes* of Patagonia and the true chrysochlorids of South Africa owed their resemblances not to direct relationship but to a common origin from northern stock of Paleocene or Eocene age. The peopling of oceanic islands with small mammals he attributed to chance transportation, as by natural rafts, hurricanes, etc., rather than to former connections with the mainland. In this connection one naturally recalls his carefully considered palæogeographic maps ("Hypothetical Outlines of the Continents in Tertiary Times," 1906)[1] and polar projections, which greatly assist in the visualization of his views on the migrations of mammals.

The numerous criticisms and objections which were called forth by this theory naturally cannot be considered in the present paper; but it may be permissible to express the feeling that, although Doctor Matthew's general theory of mammalian dispersal may eventually be modified in detail, involving possibly the existence of certain land bridges whose reality he denied, there will be a large residue of well tested evidence in favor of the Holarctic origin and subsequent dispersal of many families of placental mammals along the general lines indicated in his maps.

SUMMARY

In brief summary the papers cited here represent Doctor Matthew's chief contributions to knowledge of fossil and recent carnivores, insectivores, primates, rodents, edentates, marsupials, condylarths, periptychids, amblypods, artiodactyls, etc. In addition but only glanced at in this scant review, are his faunal lists of Tertiary mammal horizons, his studies in many fields and museums of the Tertiary and Quaternary faunæ of North and South America, Europe, India, Mongolia, Burma, Java, etc., and his analyses of these faunæ and of their migrations in past ages. Some of his more general conclusions may also be reiterated: on the mode of deposition of the mammal-bearing horizons of the west, on the origin of the "serial" carpus, on the merits of the so-called "horizontal" as compared with the "phylogenetic" classifications, etc., and especially his well known views on the arboreal origin of the mammals, on the relative permanency of ocean basins, on the doctrine of isostasy in its bearing on the problems of geographic distribution, on the Holarctic origin of the majority of the mammalian faunæ of the world. All this, he inferred, was under the control of the secular lowering of temperatures that repeatedly caused the onset of harsh and variable climates, thus intensifying the pressure of Natural Selection toward higher body temperatures and superior protection against the extremes of heat and cold.

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[1] 1906. Bull. Amer. Mus. Nat Hist, XXII, pp. 353–384, 7 text figs

Thus, due to the lasting importance of his contributions to vertebrate palæontology, and to the stimulating nature of his publications, it cannot be doubted that in time to come Dr. Matthew's colleagues, his students and successors will push on toward the solutions of the major problems of earth-history and evolution, which were always his ultimate objectives; nor will these workers fail to add greatly to the new facts of science, which he prized far more highly than its theories.

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DIPTERA COLLECTED BY DR. A. THIENEMANN IN JAVA

By C. H. Curran

The Diptera recorded herein were collected by Professor Dr. A. Thienemann in connection with limnological studies conducted in Java during 1928 and 1929. A general account of the limnological work has been published in Archive fur Hydrobiologie, Supplement-Band VIII, 1930. The material was preserved in alcohol but has been mounted. A few specimens are in poor condition and it is not possible to definitely identify these until fresh material is available for comparison. The American Museum of Natural History is indebted to Dr. Thienemann for this interesting collection of Javanese flies.

CHIRONOMIDÆ

There are two species, probably belonging to the genus *Spaniotoma* Philippi, but they are too poorly preserved for identification. They were taken on the summit of Mt. Lawu (10,000 ft.), December 18, 1928.

SCIARIDÆ

Two species, taken along with the preceding: one is pale brownish yellow, with paler pleura and legs, while the other is black.

MYCETOPHILIDÆ

Mycetophila binotata Brunetti

Brunetti, 1912, 'Fauna Brit India,' I, p. 118.

A female taken on the top of Mt. Lawu, December 18, 1929, agrees with the description given by Brunetti of the Indian specimens comprising the type series. The species has not previously been recorded from Java.

SYRPHIDÆ

Epistrophe nectarinus Wiedemann

Syrphus nectarinus Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 128.

A female taken along a ditch on the Dieng Plateau, middle Java, June 4, 1929.

Melanostoma ambiguum Fallen

Syrphus ambigua FALLEN, 1817, 'Dipt. Suec.,' Syrph., p. 47.

A female taken at the same place as the preceding. The species has been recorded by de Meijere.

ORTALIDÆ

Herina thienemanni, new species

Figure 1

Black; abdomen violaceous, face and front orange, halteres whitish; wings cinereous hyaline with the base and four fasciæ brown. Length, 5.5 mm.

MALE.—Face, cheeks, and front pale orange, the sides of the face broadly and the narrow frontal orbits white pollinose. Front with three black spots at the vertex, the lateral ones extending to a little beyond the single orbital bristle, the median one covering the ocellar triangle; front longer than wide, the sides gently diverging anteriorly; with sparse, very short black hair, the middle mostly bare on the upper half. Occiput black, moderately cinereous pollinose, the orbits whitish on the lower half. Hair black, bristly, short. Cheeks scarcely one-third as wide as the height of the oval eyes. Facial carina very broad, the antennal grooves not limited below; face perpendicular; clypeus not projecting, brown. Palpi reddish yellow, black-haired. Proboscis brown. Antennæ reddish yellow, the third segment mostly brown, with almost parallel sides, the apex broadly rounded, whitish tomentose; arista rather short, thick on the basal third. The single pair of orbital bristles is rather weak, the verticals situated well in from the eyes and moderately strong, the postocellars weak and slightly divergent.

Thorax black, cinereous pollinose, the disc of the mesonotum shining black; humeri reddish brown. No acrostical bristles and only one pair of dorsocentrals situated close to the scutellum; two pairs of strong scutellar bristles but no hair; one sternopleural and one propleural bristle, the middle of the propleura bare.

Legs black, without bristles except on the ventral apex of the middle tibiæ.

Wings cinereous hyaline, with brown markings as shown in figure 1. Squamæ and halteres whitish.

Abdomen black, with strong violaceous and bluish reflections, without bristles, the hair very short and black. The abdomen is twice as long as wide, gently tapering basally and apically, gently convex above.

TYPES.—Holotype, male, and paratype, male, Saranga, Java, December 18, 1928, on the summit of Mt. Lawu, 10,000 ft., (Dr. A. Thienemann) (F. S. 13).

I place this species in *Herina* Desvoidy with some doubt, since I have no representatives of the genus from Europe. The species described differs from species of *Ortalis* Fallen in lacking acrostical bristles, and in having narrower wings and abdomen.

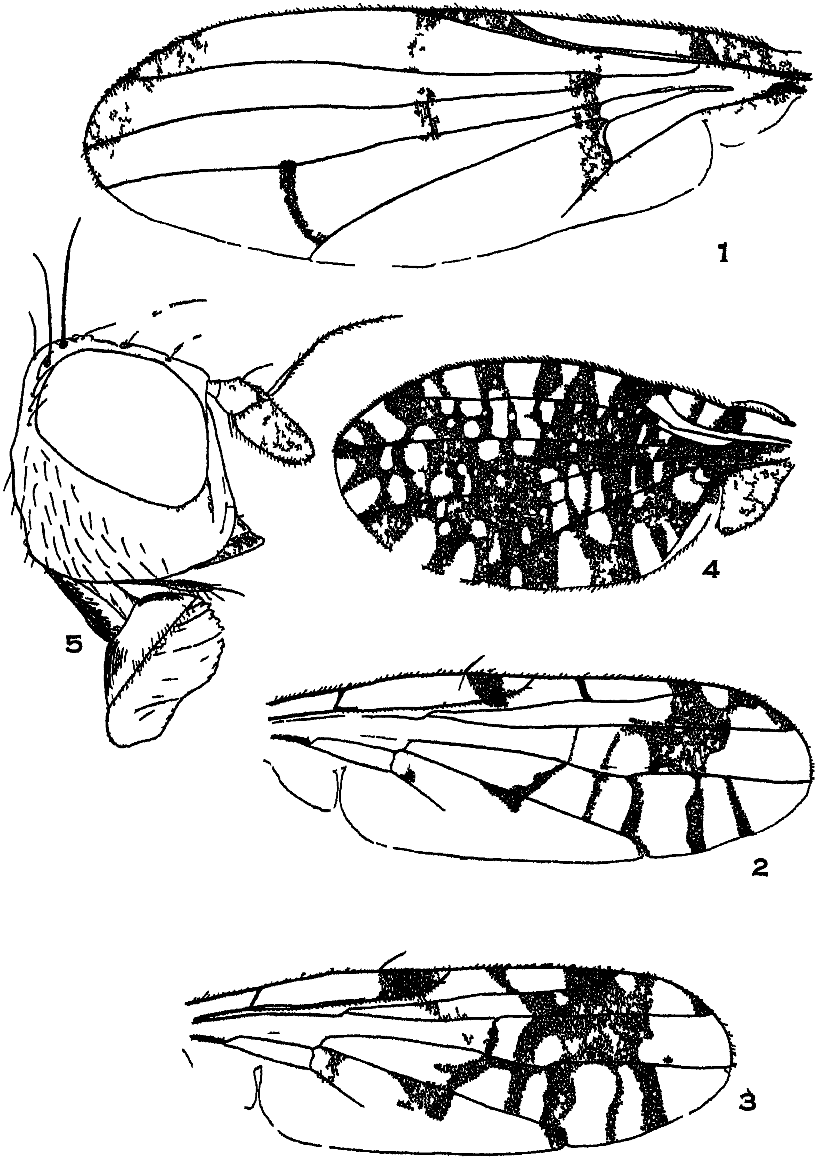

Fig 1 *Herina thienemanni*, new species Wing
Fig 2 *Trypanea sarangana*, new species Wing of male
Fig 3 *Trypanea sarangana*, new species Wing of female
Fig 4 *Homoneura sarangana*, new species Wing
Fig 5 *Homoneura abana*, new species Head in profile

TRYPANEIDÆ

Tephritis parca Bezzi

Oryna parca BEZZI, 1913, Mem. Indian Mus., III, p. 159, (f.).

Two males and three females, taken on the summit of Mt. Lawu, 10,000 ft., December 18, 1928, agree with the description of the specimens described from Calcutta, India.

Tephritis montana de Meijere

DE MEIJERE, Tijd. voor Ent., LXVII, p. 223, (f.).

Thirteen specimens from the summit of Mt. Lawu, December 18, 1928. The species was originally described from Pangerango.

Trypanea sarangana, new species

Figures 2 and 3

Black and reddish yellow; thorax cinereous, the abdomen brown pollinose; wings whitish, with brown markings as shown in the figures. Length, 3 to 4 mm.

MALE.—Head reddish yellow, the face and frontal orbits paler; occiput black above. Front longer than wide, widening posteriorly, flat, with four or five pairs of black orbital bristles, the anterior three pairs converging, the upper two pairs reclinate, the upper pair sometimes white; vertical and ocellar bristles blackish; occipital bristles and hairs whitish, Head as long as high, the oral margin as prominent as the antennal base, the face gently concave in profile; cheeks scarcely one-fifth as wide as the eye-height, with tiny black hairs below. Palpi and proboscis reddish yellow, the palpi with black hairs. Antennæ reddish yellow, third segment rounded at the lower apex, angular above; arista brown, thickened on the basal fourth, pubescent, the base yellowish.

Thorax black in ground color, cinereous pollinose, the humeri and notopleura yellow; bristles black, the hair whitish; scutellum with one pair of bristles and with hair only on the sides, its disc flat.

Legs, including the coxæ, reddish yellow, the hair and bristles black.

Wings whitish, with brown markings in general as shown in figure 2, the brown however, somewhat variable and probably varying between the extremes as represented by figures 2 and 3. Squamæ with cinereous tinge and more or less brown border exteriorly. Halteres yellowish, the apex of the knob more or less brown, always distinctly darkened.

Abdomen blackish, with rather thin, brown pollen, the hair white; third to fifth segments each with one or two black bristles on either side.

FEMALE.—The wing of the single female is shown in figure 3 and probably represents an extreme in dark coloration rather than a sexual difference. The ovipositor is moderately narrow, tapering to the truncate apex, and shining black in color.

TYPES.—Holotype, male, allotype, female, and five paratypes, males, Sarangan, Java, December 18, 1928, on the summit of Mt. Lawu, 10,000 ft., (Dr. A. Thienemann) (F. S. 13, F. S. 12).

SAPROMYZIDÆ

Homoneura sarangana, new species

Figure 4

Most nearly related to *picta* de Meijere[1] but at once distinguished by the presence of five hyaline costal spots in the marginal cell and other differences in the wing-pattern etc. Length, 3.1 mm.

FEMALE.—Head yellowish, with brown markings. Face with three brownish spots below, a subtriangular one on either side inside the vibrissal hairs and a transverse, oval spot in the middle; above with a spot below the base of each antenna and another on the orbits opposite the antennæ; front with a pair of broad, anteriorly convergent vittæ and the ocellar triangle brown; middle of the occiput, extending to the orbits at the sides, brownish. Front wider than long, the sides gently diverging posteriorly, the bristles strong. Cheeks scarcely one-fifth as wide as the eye-height. Face somewhat receding, the clypeus produced; three short, bristly hairs on the rounded vibrissal angles. Palpi cylindrical, yellow, with black hair; proboscis yellowish. Antennæ yellowish, with black hair, the third segment missing. In *picta* de Meijere the third antennal segment is brown on the apical half and the arista short-haired, in which characters *sarangana* probably agrees. De Meijere's figure of the head of *picta* shows the face to be perpendicular.

Mesonotum dull reddish-yellow, in front of the suture with a row of four rather triangular brown spots, two brown spots on either side on the suture, six between the roots of the wings and three in front of the scutellum, most of the sparse hairs and bristles arising from brown spots. Scutellum brown, on either side with a large yellowish spot beyond the basal bristles, in the middle near the base with a grayish spot. Pleura brown, the middle of the mesopleura grayish; broad upper border of the sternopleura, a band over the lower edge of the pteropleura, extending to the posterior spiracle, and a band in front of the middle coxæ, rather yellowish, the propleura yellowish.

Legs whitish yellow, the posterior four femora brownish yellow except apically; anterior coxæ yellowish, the others yellowish brown; without unusual bristles.

Wings brown and hyaline as shown in figure. The illustration of the wing undoubtedly shows a greater width than is natural, since one wing was removed from the specimen and mounted in order that the exact pattern could be drawn. This fact must not be overlooked when making comparisons.

Abdomen brownish black, with whitish-yellow markings; first and sixth segments pale, the first with the posterior border and the sides blackish, the sixth with the lateral margins black. Second to fifth segments each with a pair of large, subtriangular dorsal pale spots, those on the fifth segment extending the whole length of the segment, and with smaller, but still large, lateral pale spots, the pale dorsal spots on the third and fourth segments each with a small, semicircular brown spot in the middle at the base. Venter brown. Hair and bristles black, the first to fourth segments each with a row of marginal bristles.

TYPE.—Female, Sarangan, Java, December 9, 1928, taken near the source of a small creek at Lake Pasir, elevation about 3900 ft., (Dr. A. Thienemann).

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[1] *Drosomyia picta* de Meijere, 1904, Bijdr. Dierkunde, V, Afl. 18, p. 114 (f.).

Homoneura abana, new species

Figure 5

Black, the abdomen bronzed; wings with luteous tinge; legs simple, partly yellowish; mesonotum with cinereous pollen and brown vittæ. Length, 3.25 to 3.5 mm.

MALE.—Head reddish yellow, the upper half of the occiput, front and a large rectangular spot on the anterior half of the cheeks black or brown; anterior border of the front and an incomplete median vitta reddish yellow. Occiput and front with cinereous-brown pollen, the facial and frontal orbits cinereous pollinose. Front wider than long, strongly widening posteriorly. Occiput wide, with black hair and bristles. Face gently produced below in profile, the clypeus prominent. Palpi brown, black-haired. Proboscis brownish red, the labellæ large (inflated in the specimen from which the drawing was made). Antennæ brown, the third segment reddish yellow at the base below, the others more or less reddish below; arista with short rays above and below.

Thorax blackish or brown, moderately cinereous pollinose, the notopleura, middle of the propleura and the lower part of the metapleura more or less reddish yellow;, mesonotum with four brown vittæ. Acrostical hairs short and fine, occurring only behind the suture, in two rows, the posterior pair developed into bristles; dorsocentrals 1–3; scutellum bare except for the two pairs of marginal bristles; anterior sternopleural weak (strong in the female).

Legs brownish; apices of the femora narrowly reddish; bases of the tibiæ broadly reddish-yellow; anterior coxæ with a broad yellow vitta in front; hair and bristles black; only ordinary bristling. Basal segment of the posterior four tarsi yellowish.

Wings with strong luteous tinge. Squamæ yellowish, the fringe yellowish brown. Halteres yellow, the knob brownish.

Abdomen bronzed, with violaceous reflections; thinly cinereous pollinose; venter brown and brown pollinose; hair and bristles black. Genital lamellæ projecting, shining brown, the outer lamellæ tapering, acute at the apex.

FEMALE.—Agrees with the male but the anterior sternopleural bristle is strong.

TYPES.—Holotype, male, allotype, female, and one male paratype, Sarangan, Java, December 18, 1928, taken on the summit of Mt. Lawu, 10,000 ft., (Dr. A. Thienemann).

This species is evidently related to *coffeata* de Meijere but the brownish halteres, wider parafrontals, etc., will at once separate it.

AGROMYZIDÆ

Cerodontha species

There is a single male specimen belonging to this genus taken on the summit of Mt. Lawu, 10,000 ft., December 18, 1928. I find no record of the genus from the Island and leave its specific determination until a later date.

BORBORIDÆ

The genus *Cypselosoma* Hendel is included in the Borboridæ with considerable doubt, since the posterior tarsi have the basal segment simple and not shortened and broadened.

Cypselosoma flavinotata de Meijere

Lipothemma flavinotata DE MEIJERE, 1914, Tijd. voor Ent., LVII, p. 271, (f.).

Four specimens, Tjibodas waterfalls, from Tjiborom, on rotting banana plants.

Hendel described the genus *Cypselosoma* with *gephyræ* Hendel as the sole species, from Formosa in 1913. In 1917 de Meijere placed his *L. flavinotata* as a synonym of *gephyræ,* but there are certain differences which lead me to maintain the Javanese forms as distinct. It is, of course, possible that the species is variable, but the specimens before me are identical in coloration. All of them have a broad, whitish-yellow stripe along the upper edge of the sternopleura as described by Hendel and not a narrow one as indicated in de Meijere's description. There is no trace of reddish color on the scutellum but instead there is a whitish, rectangular apical spot.

TETANOCERIDÆ

Sepedon plumbellus Wiedemann

WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 577.

Sixteen specimens, representing both sexes, from Dieng Plateau, middle Java, along swamp ditch.

These specimens are all uniform in color but fall within the limits of variation accepted for *plumbellus* which was originally described from China. It is widely distributed in the Oriental region.

MUSCIDÆ

Cœnosia species

One male and three females from Sarangan, top of Mt. Lawu, 10,000 ft., December 18, 1928.

This species is new to Java and does not appear to be any of the species described from the East Indies. However, it might easily be a species previously recorded from continental Asia

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THE DISPUTED STRUCTURES OF THE MESONACIDÆ AND THEIR SIGNIFICANCE

BY GORDON K. BELL, JR.

ABSTRACT

The disputed generic distinctions between *Olenellus*, *Mesonacis* and *Pædeumias* are examined. *Olenellus* and *Pædeumias* have similar structures posterior to the fifteenth segment of the thorax. Moreover, both genera have glabellas which do not reach the anterior margin of the cephalon while neither of them has uniformly developed intergenal spines. *Pædeumias* and *Olenellus* are, therefore, identical The name *Olenellus* is retained through precedence, but Walcott's description of *Pædeumias* is the correct one for this fossil. *Mesonacis* differs from *Olenellus* in that it has a glabella which reaches the anterior margin of the cephalon and also in its possession of pleuræ on the rudimentary axial segments. Several species supposedly of *Olenellus*, whose pygidia and posterior segments of the thorax are unknown, belong in reality to the genus *Mesonacis*.

The Mesonacidæ possess facial sutures that are imperfectly fused, the remnants of which are seen on a few specimens of *Olenellus*, where their true course may be observed. These sutures, being of an advanced Opisthoparian type, indicate that this family belongs unquestionably to the order Opisthoparia.

The different adaptive features of both adult and young indicate that the Mesonacidæ were highly specialized, benthonic types which died out in the Lower Cambrian. The manner in which specialization occurs in this family indicates that the development of the different genera proceeded according to Raymond's theory, namely, that segments increase in number at the expense of the pygidium during evolution and do not become fewer as those scientists maintain who look to an annelid ancestry for the trilobites. As an example, *Mesonacis* is descended from *Olenellus* and is not ancestral to it. The Mesonacidæ exemplify an end stage in trilobite evolution and in no way disclose the origin of this subclass of crustaceans.

INTRODUCTION

The family Mesonacidæ is considered by most palæontologists to belong to the order Opisthoparia, Raw (1925, p. 311) and Swinnerton (1919, p. 110) being exceptions. It is described in the Eastman edition of Zittel's "Textbook of Palæontology" (1913, p. 692) as: "Opisthoparia with large cephalon and small and simple pygidium. Facial sutures in a state of symphysis and not to be distinguished. Eyes large, the palpebral lobes extending to the glabella. Glabella narrow, sometimes tapering towards the front. Thorax of numerous segments (thirteen to twenty-seven)." It should be added that these trilobites were benthonic crawling types and occasional burrowers in the mud (Raymond, 1920*b*, p. 101).

The Mesonacidæ are among the earliest known trilobites. They are confined to the Lower Cambrian, where they are the most numerous of this subclass of crustaceans. This family has certain peculiar structures that have led scientists to arrive at contradicting conclusions concerning the origin and development not only of the Mesonacidæ, but also of the whole subclass Trilobita. It is in order to determine clearly these disputed structures and to expose their true significance that this paper is written.

It is not the purpose of this article to describe in detail the different genera and species of the Mesonacidæ, but rather to clarify some of the disputed structures and theories of development of this family as a whole. In order to discuss intelligently their evolution and ontogeny, their principal structures should be carefully studied and, if possible, firmly established. Considering all that has hitherto been written about them and inferred from them, this task is quite sufficient for the present without delving into detailed classifications. Indeed, a revision of the genera *Nevadia*, *Callavia*, *Holmia*, and *Elliplocephala* and their respective species is undoubtedly needed. An examination of Walcott's[1] figures leads one to conclude that many of them are doubtful in their appearance, since it is not known how much the specimens have been touched up.

MATERIAL

In studying the Mesonacidæ the writer has had at his constant disposal specimens of *Pædeumias transitans*, *Olenellus thompsoni*, and *Wanneria walcottanus* from Pennsylvania and Vermont. These trilobites constitute three accessions in the department of Invertebrate Palæontology of the American Museum of Natural History. The writer has also examined specimens from Vermont in the Columbia University collection and some of the specimens from different parts of North America at the National Museum in Washington, D. C. He has also

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[1] See Walcott, 1910, Pl. xxiii, Figs. 1, 4, 7; Pl. xxiv (complete); Pl. xxv (complete); Pl. xxviii, Figs. 4, 8; Pl. xxix (complete); also, Pl. xxiii, Fig. 5; Pl. xxiv, Figs. 3, 4, 6, 7.

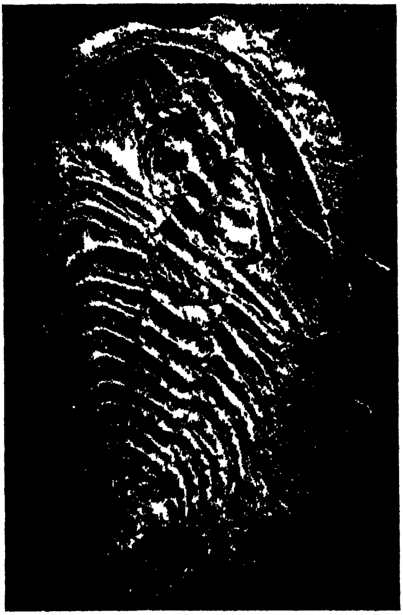

Fig. 1

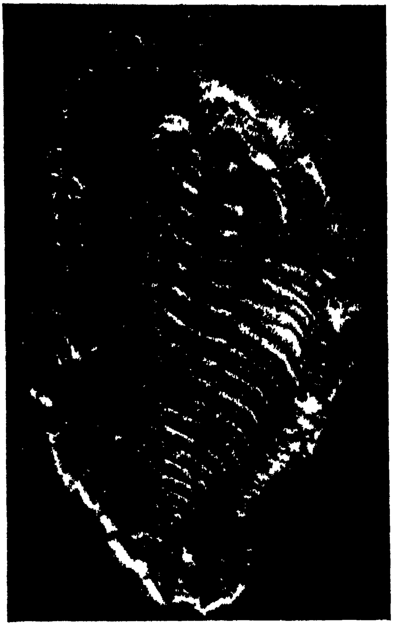

Fig. 2

Fig. 1. Mold of *Olenellus thompsoni* (×1.5), Lower Cambrian, Pennsylvania, showing the rudimentary segments of the thorax to the left of the spine on the fifteenth segment.

The facial sutures may also be recognized although they are considerably distorted due to the compression of this fossil. Both sutures extend from a point near the anterior end of the eyes to the margin [illegible] dis[illegible] the glabella is bent back from distortion so as to intersect the border at a po[illegible] distance from the genal angle to the anterior margin of the cephalon. American Museum of Natural History. Accession 153.

Fig. 2. Mold of *Olenellus thompsoni* (×1.5), Lower Cambrian, Pennsylvania, showing the facial sutures.

The spine on the fifteenth segment of the thorax extends posteriorly in a straight line and so conceals the posterior rudimentary segments. American Museum of Natural History. Accession 160.

examined specimens from Vermont and Virginia, as well as some very well preserved ones that were collected in the summer of 1929, from Alberta, now in the Museum of Comparative Zoölogy at Harvard University. The trilobites from Jasper Park in Canada are in many cases in an excellent state of preservation and exhibit features that are rarely preserved on mesonacid trilobites from other localities.

The bulk of the American Museum specimens which the writer has studied in detail are from the Lower Cambrian of Pennsylvania. These are contained in two accessions that were purchased in 1911, the one from I.S. and S.S. Simmons, and the other from Professor Atreus Wanner. The precise locality from which these fossils were collected is unknown. However, it is certain that it was somewhere in the Lancaster quadrangle (Lancaster County, Pa.), at or near the Fruitville quarry or at Noah Getz' quarry near Rohrerstown. The Simmons collection came from the beds at the base of the Kinzers formation of the Lower Cambrian, which has been described as follows: "Fossiliferous earthy blue dolomite, weathering to buff or orange-colored tripoli with hard brown skin; . . . . 7 [feet]" (Jonas and Stose, 1930, p. 28). The Wanner collection comes from the dark shales that overlie the earthy blue dolomite near the base of the Kinzers formation (Ibid.). There are but two species in both collections, *Pædeumias transitans* and *Wanneria walcottanus*. Approximately half the fossils have only the cephalon preserved. In the Wanner collection all the specimens are carefully numbered and listed, while in the other about one hundred have been arranged in a study series, being sufficiently well preserved to enable the student to draw conclusions therefrom.

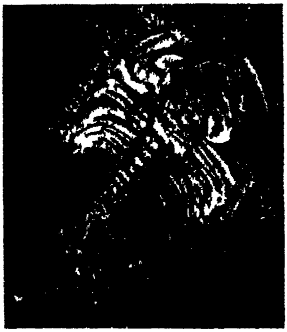

Fig. 3. Mold of *Olenellus thompsoni* (×1.5), Lower Cambrian, Pennsylvania, showing the facial sutures and also the spine on the fifteenth segment of the thorax pushed to one side by the posterior rudimentary segments.

A small remnant of these segments may be discerned to the left of the spine American Museum of Natural History Accession 100

In addition to these two accessions there is one in the James Hall collection of 1870, which consists of about a dozen specimens of *Olenellus thompsoni* from the Lower Cambrian of Vermont. These are dark sericitic shales on which the trilobites are usually but imperfectly preserved. The general outlines are fairly complete, but the detail embodying such structures as eyelobes, appendages, spines, etc., are in most cases blurred and impossible to distinguish accurately. One specimen, however, is very well preserved in nearly all its detail. This trilobite is especially interesting as it was sketched and described by Whitfield in 1884. This fossil has been photographed by the writer and is herewith given in figure 4.

The writer wishes to thank Dr. Chester A. Reeds, Dr. Percy E. Raymond, and Dr. J. J. Galloway for the invaluable assistance which they rendered on different occasions, and which enabled this paper to be written. Also, thanks are due to Dr. Charles P. Berkey and Dr. H. N. Coryell for their timely suggestions.

OLENELLUS, MESONACIS, AND *PÆDEUMIAS*

One of the most disputed features of the Mesonacidæ is the structure of *Olenellus, Mesonacis,* and *Pædeumias,* and consequently their respective delimitation and classification. *Olenellus* was first described by Hall as *Olenus* (Hall, 1859). It was later redescribed by him as *Barrandia* (Hall, 1860). Finally, when he discovered that the latter name was to be employed for another fossil before his own description would be published, he had it changed to *Olenellus* (Hall, 1862). It was later revised by Whitfield in 1884, who sketched a specimen which has been photographed and included in this paper. This specimen is, therefore, the first of the type specimens originally described to become reproduced later in an untouched photograph.

When Hall first described *Olenellus*, he ascribed two species to this genus—*thompsoni* and *vermontana* (Hall, 1859, 1860). The former has remained the genotype to this day, but the latter was found by Walcott in 1885 to merit being placed under a new genus. He named it *Mesonacis* and described *Mesonacis vermontana* as the type species, which it has remained ever since.

Finally, in 1910, Walcott described a new genus and species, *Pædeumias transitans.* He had been studying specimens from Pennsylvania, that were supposed to be *Olenellus thompsoni,* when he discovered that many of them had from two to six rudimentary segments and a small plate-like pygidium posterior to the spine-bearing fifteenth segment of the thorax. This feature differed so markedly from the pygidium, or rather the telson of *Olenellus* (Ibid., p. 312), as he had formerly described it, that he felt that these fossils belonged to a different genus.

Both before and, especially, since, the discovery of *Pædeumias,* the structure of the posterior portion of *Olenellus* has been keenly disputed. Walcott believed the pygidium of this fossil to be a long telson much like that seen in the modern horseshoe crab, *Limulus polyphemus.* This view, however, has since been discarded by Resser (1928, p. 5), Raw (1927, p. 137), and Raymond (1920*b*, p. 100). Resser merely states his belief that *Olenellus* has a *Pædeumias*-like structure posterior to the fifteenth segment of the thorax, while Raymond reaches the same conclusion as the result of a zoölogical interpretation of trilobite structure. Raw regards *Olenellus* as merely having lost the rudimentary segments seen in *Pædeumias,* having reached one stage further than the latter in the evolution of the Mesonacidæ, as he interprets it. However, none of these writers has discussed this feature from the viewpoint of a graphic examination of observed structure, and their considerations of the biological interpretations are sufficiently brief to warrant further investigation.

In most specimens of *Pædeumias* the rudimentary segments are poorly preserved compared with the rest of the trilobite. They may be seen on the specimen in figure 1 where they appear to be very delicate as compared with the other structures. It should be noted that the spine on the fifteenth segment of the thorax appears to have been pushed out of the normal position by these segments. This feature was apparently regarded by Walcott as a means of identifying this fossil when the rudimentary segments were not preserved. Some of his figured specimens show this type very clearly (Walcott, 1910, Pl. xxxiv, Figs. 1, 2, 3, 9). However, when this spine was not pushed aside it frequently covered up these segments when the animal was buried in the mud, and so *Pædeumias* became indistinguishable from a supposedly telson-bearing *Olenellus.* The specimens in figures 2 and 4 show this feature. Furthermore, when the trilobite is poorly preserved throughout, which is the case with most of the specimens from Vermont, the rudimentary segments of the thorax and the small plate-like pygidium, the structures most easily destroyed, may become blurred and confused with the axial spine, which thus appears remarkably broad at the anterior end and tapers posteriorly, thereby acquiring also a striking resemblance to a typical *Limulus*-like telson. Indeed when the rudimentary segments are observable there can be no question about the pygidium. Unfortunately, however, this is rarely the case. In fact, these segments were discovered but comparatively recently and were first described only in 1910 by Walcott (p. 304). Since *Olenellus* had been known as long ago as 1859, it is not surprising that this fossil should have been considered as having a terminal telson, especially when specimens like that in figure 4 were studied. We have seen that the rudimentary segments of the thorax and pygidium of *Pædeumias* have been clearly shown to exist, but that, on the other hand, there is nothing in the appearance of the fossil to indicate with certainty the existence of the telson-like pygidium of

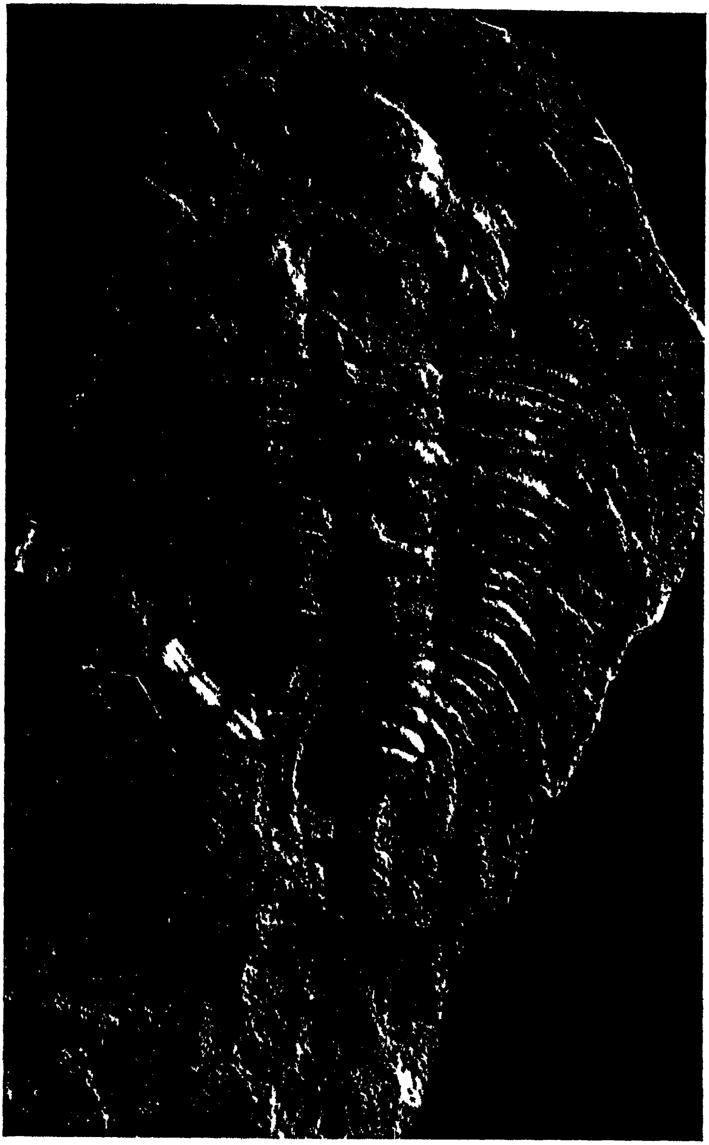

Fig. 4 Mold of *Olenellus thompsoni* (natural size), Lower Cambrian, Vermont.

This specimen was found in Parker's quarry, Georgia, Vermont and is one of the best specimens known It was described and figured by R P Whitfield in 1884 and is the earliest of the described specimens to be reproduced in an untouched photograph American Museum of Natural History. Catalogue No 223

Olenellus. A biological interpretation must, therefore, be looked to as the only alternative to indicate the existence of the latter structure, and so it is to this aspect of the discussion that we must now turn.

The principal proponents for a telson for *Olenellus* are Walcott and Swinnerton. Swinnerton (1923, p. 247) explains that the telson is found in the most primitive trilobites, and that new segments are formed from tissue produced at its anterior margin. The pygidium is then found only when these segments are not separated from each other as quickly as they are produced. He gives *Nevadia* as a typical example of the primitive trilobite with a telson. In so doing he has gone further than any other writer, including Walcott, who thus described this fossil: "Pygidium apparently a continuation of the axial lobe without pleural lobes or spines; it is a small and, as far as can be determined from compressed specimens, it is a simple plate of about equal length and breadth that narrows toward the posterior margin" (Walcott, 1910, p. 259). An examination of this fossil in figure 14 shows no change in the structure of the axial portion except at the posterior end where a small plate-like pygidium may be seen (Ibid., p. 257). However, if this theory about the pygidium of trilobites holds for this fossil, its origin and development are altogether different from that given by Walcott, who, describing the *Olenellus* stage in the development of the Mesonacidæ, states: ". . . the fifteenth segment a strong terminal telson; posterior rudimentary segments and true pygidium of the *Pædeumias* stage absorbed or the rudimentary segments and pygidium have disappeared and the large median spine of *Pædeumias* has become the telson of *Olenellus.*" (Ibid., p. 245.)

We now have two contradictory theories for the existence of the telson in trilobites. According to Swinnerton the telson is a primary structure and the pygidium a secondary one, whereas according to Walcott it is precisely the reverse. Swinnerton does not explain the existence of the telson beyond implying that it should exist due to its similarity to the structure of the annelid whence trilobites are supposed to have been descended. He appears merely to have postulated its existence in order to explain the development of trilobites. So little evidence of the existence of a telson as Swinnerton offers must be rejected until he has presented some more substantial proof. Walcott's theory, on the other hand, appears to have been postulated in order to explain a structure which has been shown to possess a very deceptive appearance. That there is nothing in the appearance of the pygidium of *Olenellus* to lead one to regard it as a telson places the burden of proof on Walcott's explanation of its existence. Concerning that explanation Raymond exclaimed: "This would mean the cutting off of the anus and the posterior part of the alimentary canal and developing a new anal opening on the spine of one of the thoracic segments!" (Raymond, 1920*b*, p. 101). Since the theories of Walcott and Swinnerton lack substantial evidence, and are unsupported by other writers, they cannot be accepted.

The only other writer to draw distinction between *Olenellus* and *Pædeumias*, according to differences of pygidial structure, is Raw. He regards *Olenellus* as an end form in the evolution of the Mesonacidæ, which had lost all of the rudimentary segments in *Pædeumias*. (Raw, 1927, p. 146). According to him the difference between these two fossils is purely theoretical. Since it has been shown that the rudimentary segments and pygidium of this fossil are easily destroyed and become often confused with the spine on the fifteenth segment of the thorax, there can be no way of knowing that they did not once exist. His distinction is, therefore, too impracticable for purposes either of identification or of classification, especially since this fossil is usually destroyed posterior to the fifteenth segment of the thorax. The developmental aspect of Raw's theory will be dealt with in detail further on. These two genera must, therefore, be regarded as possessing identical structures posterior to the fifteenth segment of the thorax so that distinctions between them must be looked for in other parts of the body.

Differences in the cephalon between *Olenellus* and *Pædeumias* were mentioned by Walcott (1910, p. 338), and were later summarized and dealt with in greater detail by Resser who classified these two genera along with *Mesonacis* according to their distinctions in this structure (Resser, 1928, p. 5). Resser considers that *Olenellus* and *Pædeumias* differ only in the cephalon, while *Olenellus* and *Mesonacis*, similar in the cephalon, differ chiefly in the posterior segments of the thorax and pygidium. It is, therefore, evident that according to his classification *Pædeumias* and *Mesonacis* must differ in both cephalon and pygidium. It should be mentioned that Resser accepts Walcott's description of the posterior portions of *Mesonacis* and *of Pædeumias*, and that the description of the latter genus applies as well for *Olenellus.*

According to Resser the cephalon of *Pædeumias* is characterized by intergenal spines and by a glabella which fails to reach the anterior border of the cephalon, as contrasted with the cephalon of *Mesonacis* and *Olenellus* in which there are no intergenal spines and in which the glabella touches the anterior border. According to him the only way in which *Olenellus* differs from *Mesonacis* in the cephalon is by the greater length of the eyes and by a doubtfully wider rim (Ibid.).

In the writer's collection there is great variation in the development of intergenal spines. Many of them, as in figures 2 and 4, lack intergenal spines and, at the same time, have a glabella which does not reach the anterior margin of the cephalon. This feature alone eliminates intergenal spines as a factor of importance in classification.

In pointing out differences in the forward extension of the glabella, Resser has contributed a most valuable means of distinguishing *Mesonacis* from *Pædeumias*. However, according to this classification *Olenellus* remains ambiguous. The breadth of the cephalon affords no criterion for distinction, especially since the rim of the type specimen of *Mesonacis gilberti* is as broad as that of any specimen of *Olenellus* or *Pædeumias* (Walcott, 1916, pp. 406, 412). Moreover, the eyes are approximately as long as those on either of these fossils. Resser points out that Walcott's rendering of *Olenellus thompsoni* is based not upon Hall's original figures but upon an incorrect restoration of a very poorly preserved specimen (Resser, 1928, p. 4). He goes on to state: "This figure, as Walcott stated in 1910 (description of Pl. xxxv, Fig. 1), is incorrect in representing the anterior lobe of the glabella as not reaching the rim" (Ibid.). Indeed, Walcott stated that the glabella of this fossil had been crushed down even with the surface of the cheeks so that its termination at the border was not observable (Ibid., p. 404). However, it is doubtful whether it would have reached the border even had it not been crushed.

Walcott referred to Hall's original figure of *Olenus thompsoni* as showing the anterior lobe of the glabella terminating in front at the marginal border (Ibid., p. 338). An examination of this figure shows the eyes and the glabella so completely destroyed that one cannot determine their exact position on the cephalon (Hall, 1859, p. 60, Fig. 1). The following year Hall redescribed this fossil as *Barrandia thompsoni* along with *Barrandia vermontana* which was later renamed *Mesonacis vermontana* by Walcott (1885, p. 328). This second description of Hall's is much more detailed and complete than his first one, of which he stated at the time he wrote it that it was only superficial and needed to be revised (Hall, 1859, p. 59). He figures *O. thompsoni* with the glabella not reaching the anterior border, as contrasted with that in *O. vermontana*, in which it decidedly does reach the border (Hall, 1860, pp. 116, 117). The authority of Hall's writings would, therefore, indicate that, contrary to the opinion of Walcott and Resser, the anterior lobe of the glabella in *Olenellus* did not reach the anterior border of the cephalon but was separated therefrom by a distinct space.

Indeed, Walcott states that he found many well-preserved specimens on which the anterior lobe of the glabella reached the anterior border (Walcott, 1910, p. 338). However, he does not say whether they were entire specimens or whether the pygidium was preserved. In fact, none of these specimens has been figured by either Walcott or Resser, and, until they have been figured, there is no reason to suppose that they may not be specimens of *Mesonacis.* On the other hand, the specimen which was sent to the American Museum from the type locality (Parker's quarry, Georgia, Vt.), and which Whitfield described in 1884, is extremely well preserved and has been recently photographed[1] by the writer. Indeed, Resser might regard this fossil as a specimen of *Pædeumias,* but, until one with the features of *Olenellus,* as he describes them, has been clearly shown to exist, this specimen, along with Hall's, deserves to continue to be called *Olenellus* as it was originally described. Inasmuch as neither Walcott nor Resser has shown that *Olenellus* has a cephalon like that of *Mesonacis,* and unlike that of *Pædeumias,* and since the original descriptions of Hall and Whitfield do indicate that the cephalons of *Olenellus* and *Pædeumias* are alike, these two genera must be regarded as having similar cephalons.

Thus the pygidium and cephalon of *Olenellus* and of *Pædeumias* are alike. Inasmuch as there are no other disputed differences between them, these two genera must be regarded as identical. The name *Olenellus* should be retained by virtue of precedence, but Walcott's description of *Pædeumias* is the correct one for this fossil.

It should also be pointed out that the species *robsonensis* really belongs to the genus *Mesonacis* and not to *Pædeumias.* Burling assigned this fossil to the genus *Pædeumias* because of its resemblance to *Olenellus gilberti* in all respects other than the number of rudimentary segments. However, since Walcott discovered that the latter species belonged to the genus *Mesonacis,* objections to placing the species *robsonensis* in the same genus have been removed. Moreover, the species *robsonensis* has rudimentary segments typical of *Mesonacis* in that it has pleural as well as axial segments. It differs from *M. gilberti* and *M. vermontana* only in that it has a greater number of them (Burling, 1916, p. 57, Pl. I). Furthermore, according to Resser's classification, this fossil has a glabella typical of *Mesonacis* in that it reaches the anterior margin of the cephalon.

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[1] See Fig. 4; also Whitfield, 1884, p. 151 and Pl. xv, Fig. 1. Due to the well-preserved condition of this specimen and to the fact that it is the most anciently described specimen to be reproduced in an untouched photograph, it should be regarded as the most important plesiotype of *Olenellus* at the present time.

It should also be mentioned that Resser renamed, described, and figured *Olenellus fremonti* as *Mesonacis fremonti*, and in addition described *Mesonacis insolens* and *Mesonacis bristolensis* (Resser, 1928). From what has been observed about the glabella of *Mesonacis*, the species *canadensis*, *claytoni* and *argentus* belong also to this genus.[1]

THE FACIAL SUTURE

Another disputed feature of the Mesonacidæ concerns itself with the existence of facial sutures. Mr. Frank Raw has recently revived this subject in his papers: "The Development of *Leptoplastus salteri* and other trilobites" (Raw, 1925), and "The Ontogenies of trilobites and their significance" (Raw, 1927). In both of these papers he deals largely with the general head plan of trilobites as determined by their cephalic spines. He furthermore shows the forward and backward revolution of the facial sutures of certain trilobites by the complementary migration of the cephalic spines. With regard to the Mesonacidæ he attempts to show that the facial sutures along with the cephalic spines have revolved backwards. However, before explaining this phenomenon he briefly outlines the history concerning the sutures of this family. Due to its extreme importance his summary will be herewith reproduced (Raw, 1925, p. 301).

Whitfield (1884) was the first to describe the course of the facial sutures of *Olenellus* on a Vermont specimen of *Olenellus thompsoni*. Walcott, however, rejected the former's description, stating that the sutures Whitfield described were but accidental breaks (Walcott, 1886, p. 163). Walcott then proceeded to describe the course of facial sutures on *Olenellus (Mesonacis) gilberti* as follows: "The facial suture cuts the anterior margin some distance outside the line of the outer margin of the glabella and passes obliquely inward to the anterior angle of the eye lobe; curving around the outer margin of this, it passes obliquely outward to the posterior margin, cutting it midway between the glabellar lobe and the outer margin of the genal angle." (Ibid., p. 172.) He also stated that "What I had identified as the facial suture is a raised line in the cast of the interior of the shell that fills a depressed line occupying the position of the suture." (Walcott, 1891, p. 633.) He later redescribed the posterior portion of the suture as passing from the back of the eye to the intergenal angle and being sometimes continued into a short spine (Walcott, 1910, p. 327). However, he goes on to contradict his former description of the anterior portion of the suture, stating: "No traces of facial sutures have been observed in front of the eye" (Ibid.).

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[1] See Walcott, 1910, p. 410, Pl. xxxviii, Fig. 1; p 415, Pl. xl, Figs 10, 11, 14, 15.

Raw accepts Walcott's final description of the posterior portion of the facial suture and likewise his view as to the absence of the anterior portion. He then proceeds to develop the unique theory briefly referred to above. After assuming the comparative shortening of the cephalon during growth and observing the absence of the procranidials in the adults, he attempts to show that the three pairs of cephalic spines moved downward and inward during the growth of the trilobite. He considers that the metacranidials became crowded and finally aborted, their place being taken by the encroaching parials, while the procranidials moved posteriorly to assume the position once held by the parials. He goes further to insist that the anterior portion of the facial sutures revolved back to the genal angles along with the procranidial spines, stating: "If, however, it be accepted that the genal spines of the Mesonacids are procranidials, the backward course of the suture is inevitable, for these must terminate behind (and so within) the procranidial spines." (Raw, 1925, p. 303).

Raw (1927, p. 142) arrived at the foregoing conclusions after studying Walcott's (1910, p. 305) description of *Pædeumias transitans* and has drawn his figures after Walcott (1910, Pls. xxxii and xxxiv) to illustrate his theory. His interpretation of the evolution of the trilobite from the stage represented by figure 22 to that represented by figure 23 is very doubtful, since the backward and inward revolution of the spines appears to be postulated rather than actually observed. On the other hand, it appears far more probable, according to Raw's own sketch, that the spines A and B in figure 23 (except that they are rather more developed) are the same as those represented by B and C on figure 22.

Commenting on Raw's second article, Raymond (1928, p. 168) pointed out that the parial and metacranidial spines necessarily had to move outward and not inward during the process of growth and that the metacranidials atrophied as the parials became functional. Raymond based his explanation on the ontogeny of trilobites as described by Beecher. This explains clearly the significance of the metacranidials since it shows that they protect the trilobite during the protaspis stage when the transverse structure dividing the pygidium from the cephalon first appears. It is only later that the free cheeks appear with their spines, the parials (Ibid.). These spines move outward with increase in width of the cephalon (Ibid). Such a development was described and figured by Walcott (1910, p. 326; also Pl. xxv), as Swinnerton pointed out after Raw's first paper was read. (Raw, 1925, p. 322). Swinnerton further stated that the examples Raw gave were too few to be of phylogenetic importance, even with regard to the Mesonacidæ (Ibid.). Both Swinnerton and Raymond regard these spines as due merely to larval adaptation (Ibid., also Raymond, 1928, p. 168). Swinnerton has also clearly shown the danger of attaching too much significance to the embryonic structures of trilobites (Swinnerton, 1919, p. 108). Inasmuch as there are apparent flaws in both the theoretical and observational aspects of Raw's theory, and since the majority of other writers have since regarded his view unfavorably, his entire theory must be regarded as improbable.

On the other hand, in the writer's collection one out of every fifteen specimens shows a pronounced line extending obliquely outward and forward from a point about four-fifths of the distance from the rear to the front end of the eye lobe, to the margin of the cephalon. This may clearly be seen in figures 1, 2, and 3. A similar phenomenon has been observed by the writer on specimens which were collected in Jasper Park, Alberta, by the Harvard Summer School expedition of 1929. One of these specimens not only displays the feature described above but also shows very clearly the posterior portion of the facial suture as Walcott (1886, p. 164) described it,—a feature not seen on the American Museum specimens. Inasmuch as so many of these trilobites show lines all similarly located in front of the eye, it appears only reasonable that these lines are at least the course followed by the original suture, if not the actual suture itself. These lines may conform to what Walcott (1891, p. 633) once described as a raised line in the cast of the interior of the shell that fills a depressed line occupying the position of the suture. However, they do not occur in the same place on the cephalon either as those described by Hall (1860, p. 116) and later by Whitfield (1884, Pl. xv), or as those described by Walcott (1886, Pl. xx; also 1891, Pl. lxxxvi). The course of the facial suture as described and figured by the first two writers is a great deal closer to the glabella, while the one described and figured by Walcott is also further forward and inward than the course of the sutures in the American Museum specimens. The fact that these writers had identified the wrong lines may have led Walcott later to deny the existence of the anterior portion of the facial sutures,—the view that has since been held by most writers.

An exception is to be found in the opinion of Professor Raymond (1917, p. 206), who identified the cracks on specimens figured by Walcott (1910, Pls. xxv, xxvi, xxvii, xlii) as traces of facial sutures. On the first of the figures to which he refers (*Elliptocephala asaphoides*), cracks may be seen on a distorted specimen (Pl. xxiv, Fig. 5), which more or less correspond to those on the specimens in the American Museum collection. On Plates xxvi and xxvii, however, these cracks do not appear on any of the figured specimens. But on Plate xxii the figure of a specimen of *Callavia callavei* shows these cracks very distinctly, located in the same position on the cephalon as those on the American Museum specimens. It is a curious fact that somewhat later, Raw (1925, p. 303), commenting on Raymond's observation, stated: "Raymond, 1917, p. 206, was misled by a faked photograph supplied by me (Walcott, 1910, p. 418, and Pl. xlii, fig. 1) into identifying a crack across the specimen as the anterior branch of the suture." Indeed, this figure does not look altogether natural, but it seems probable that the cracks Raymond referred to are genuine and that what he saw are the true sutures or their traces in spite of Raw's alterations.

With the course of the facial suture in the Mesonacidæ now established, Raw's theory concerning their backward revolution is impossible. Moreover, if what he states about the essential relationship of the sutures to the cephalic spines be accepted, the backward migration of the latter becomes likewise impossible. Furthermore, it may now be stated with certainty that this family of trilobites can belong only to the order Opisthoparia, of which they are typical representatives in every respect, except that their facial sutures are secondarily fused.

GENERAL DISCUSSION

The structure of the cephalon, the number of segments in the thorax, the pygidium, and the mode of life to which they were adapted, have led many writers to arrive at different conclusions concerning the origin and development not only of the Mesonacidæ but of all other trilobites as well. In writing about *Pædeumias robsonensis*, Burling (1916, p. 53) began his paper with the remark: "By common consent we are accustomed to regard the crustacea as derived from the annelids, and we have pointed to their abundantly segmented body as a reason for assigning this ancestorship to them." Raw (1927, p. 140) shows the gradual reduction of segments in a chart explaining the evolution of the Mesonacidæ from *Mesonacis* through *Pædeumias* to *Olenellus*. This view held by these writers is well summarized in Walcott's (1910, p. 249) statement: "The development of the Mesonacidæ from some annelidian-like ancestor by the gradual combination of segments to form the cephalon and pygidium is indicated by the examples cited of *Nevadia, Elliptocephala, Holmia,* and *Pædeumias.*"

Opposed to this view is Raymond (1920*a*, p. 22), who looks to a primitive arthropod as ancestral to the trilobites. He pointed out that the growing point in trilobites, as in all other arthropods, is immediately in front of the anal segment and furthermore stated that the free segments of the thorax grow through degeneration of the pygidium. In fact the greatness of the pygidium appears to be inversely proportional to the number of segments in the thorax. As an example Raymond cites the relationship of *Dalmanites eucentrus* to *Dalmanites mucronatus*. The latter occurs in beds immediately beneath the former and differs from it only by having a larger pygidium. *Dalmanites eucentrus* has a pygidium of the same proportional dimensions (with the rest of the trilobite in the larval stages) as that of *Dalmanites mucronatus* and becomes reduced only in the adult stage (Ibid., p. 23). It is, therefore, obvious that Raymond considers that the Mesonacidæ and other trilobites with small pygidia and numerous segments in the thorax are advanced in the scale of trilobite evolution, in contrast with Walcott and others who regard them as primitive.

The most detailed arguments in behalf of an annelid ancestry for trilobites is perhaps to be found in the works of Swinnerton (1919, p. 109), who saw in the Mesonacidæ features that were characteristically primitive and favorable to his theory. These were: the presence of pleuræ in the cheek region of the larval forms, the absence of facial sutures, and the dorsal location of the eyes in both adult and young (Ibid.). The fact that the eyes were dorsally located in the Mesonacidæ when no facial suture was present, indicates that there was no connection between those two organs, and that neither—certainly not the eyes——had migrated back from the border during the course of evolution. However, the existence of facial sutures as well as their true course has now been demonstrated and, therefore, Swinnerton's contention is disproved, unless it can be shown that the eyes and sutures were primitive and in the habit of traveling in the opposite direction during evolution.

In order to test this theory properly, an examination of all trilobite orders, with the exception of the Hypoparia, should be made. Turning to Zittel's "Textbook of Palæontology" (1913, p. 712, Fig. 1364, and p. 723, Fig. 1398), one finds the sutures on the cephalons of representative Opisthoparia and Proparia graphically displayed (after Beecher). An inward migration of the eye and facial sutures may be observed in both orders as the geologic column is ascended. In the Opisthoparia, the sutures of *Atops* and *Conocoryphe* of the Lower and Middle Cambrian, respectively, are close to the border. In *Olenus* of the Upper Cambrian and Ordovician, the sutures are found midway between the glabella and the border, while in Proëtus, ranging from the Ordovician to the Carboniferous, they are found close to the glabella. In the Proparia, the sutures of *Placoparia,* which is found only in the Ordovician, are close to the border; in *Cheirurus* and *Dalmanitina* of the Ordovician and Silurian, they have migrated about half way in; and in *Dalmanites,* closely related to the last-named genus but occurring later, and in *Phacops* and other Phacopidæ of the Devonian, the sutures have moved close to the glabella. In all cases, both in the Opisthoparia and in the Proparia, the facial sutures have borne the eyes and have migrated backward and inward during the course of evolution, a fact which indicates that Swinnerton's theory is highly improbable. It is furthermore evident that with regard to the facial sutures and the eyes, which appear to be highly developed, the Mesonacidæ are highly specialized and far advanced in the scale of evolution. Perhaps the most striking proof of the specialized condition of the mesonacid sutures is that the only other known example of fused sutures is to be found in *Phacops,* which is universally regarded as a very highly specialized trilobite and an end-product in the scale of evolution.

Since the sutures of the Mesonacidæ are advanced in position and development, their rudimentary or vestigial structure is due to specialization rather than to primitiveness. They are, therefore, in a state of symphysis, being in a process of secondary fusion.

Another structure in the cephalon that is often indicative of specialization is the glabella. Swinnerton (1919, p. 108) states: "Thus an increase in the width of the anterior segments of the glabella is frequently exhibited by the more advanced members of a progressive series, cf. *Olenellus* with *Nevadia.*" This statement certainly holds for one line of evolution in the Mesonacidæ, namely, that from *Nevadia* to *Wanneria.* According to Walcott's (1910, p. 249) chart, *Callavia, Holmia,* and *Wanneria* have progressively larger glabellas than those of each preceding member of the series. However, according to this statement, *Mesonacis* should be descended from, instead of ancestral to, *Olenellus* as Walcott (Ibid.) and Raw (1927, p. 140) have considered it. Both of these writers show that in the line of descent in the Mesonacidæ, *Mesonacis* was followed by *Pædeumias* which was in turn followed by *Olenellus.* Their charts differ only in that Walcott inserts *Elliptocephala* as an intermediate member between *Mesonacis* and *Pædeumias.* Raw's placing of this genus prior to *Mesonacis,* instead of between it and *Pædeumias,* is undoubtedly an improvement, since *Elliptocephala* obviously differs far too greatly from the other two to be considered an intermediate stage between them. (*Elliptocephala* has eighteen instead of fourteen segments in the thorax and also lacks the enlarged third segment of *Olenellus* and *Mesonacis*, and has altogether different posterior thoracic segments.) It has already been shown that the glabella of *Olenellus* does not reach the anterior border, whereas that of *Mesonacis* not only touches it but, in the case of *M. vermontana*, *M. fremonti*, *M. canadensis*, *M. claytoni*, and *M. argentus*, is broadened anteriorly and pushes it forward. It should be noted that with the exception of *M. vermontana* all of the above species were placed as members of the genus *Olenellus* by Walcott but have since been shown according to Resser's classification to belong to the genus *Mesonacis*. It is, therefore, only since the papers of Raw and Walcott appeared that the delimitation of *Olenellus* and *Mesonacis* in the glabella was clearly understood—thanks to Resser's classification. According to Swinnerton, *Mesonacis* followed *Olenellus* and did not precede it. The fact that the glabella in certain species of *Mesonacis* pushes the anterior margin forward is an additional specialization that is not seen in *Olenellus*, which, therefore, further confirms Swinnerton's view.

Let us consider *Mesonacis robsonensis*—probably the most extraordinary trilobite ever discovered. As in all other species of *Mesonacis*, the cephalon contains eyes and facial sutures that are specialized in structure and in position, according to Beecher's classification of the Opisthoparia. It has also a glabella that is even more specialized than that of the closely related genus *Olenellus*. Along with genal and, perhaps, remnants of intergenal spines, these features indicate that the cephalon is highly specialized in every way. The anterior fifteen segments of the thorax with its third member enlarged, all containing highly ridged and furrowed pleuræ with spines, along with the posterior twenty-nine or more rudimentary segments, a most unique structure among trilobites, appear distinctly specialized rather than primitive unless this species be closely related to the annelids. Considering the general anatomical aspects of this fossil, a highly specialized pygidium is more consistent with the specialized cephalon and thorax than would be a primitive one. This is especially true if it be borne in mind that if the pygidium were primitive it must have remained unchanged whilst the thorax and the cephalon became specialized.

Concerning the development of *Mesonacis robsonensis* as exemplifying the evolution of the Mesonacidæ from the annelids, Burling (1916, p. 55) states: "The finding of 29 rudimentary posterior segments would seem to indicate that this resorption takes place laterally, that is, they become smaller in size before they become fewer in number." In other words, after these segments had retained their rudimentary nature whilst the remainder of the animal became specialized, they underwent a radical change, both horizontally and vertically, while the rest of the trilobite remained unchanged. The lateral resorption of segments is unlikely according to any annelid theory of trilobite evolution, since it implies a narrowing and consequently a relative lengthening of the body. Furthermore, no segments have fused to form a pygidium as Swinnerton's theory maintains.

If, on the other hand, it be supposed that the Mesonacidæ were not closely related to the annelids but were specialized trilobites evolved in the manner stated by Raymond (1920*a*, p. 22), virtually no difficulties are found either in accounting for their development in the environment they had, or in reconciling their different structures with one another. The multi-segmented thorax and small pygidium, along with the specialized facial sutures, eyes, and, in the case of *Wanneria* and *Mesonacis*, the glabella, are all in keeping with one another and with the idea that this family is distinctly specialized. Due to the fact that their structures are unique among trilobites, the rudimentary segments of *Olenellus* and *Mesonacis* may also be regarded as specialized structures, especially *M. robsonensis*, whose development casts an interesting reflection on the environment of the Mesonacidæ and its stimulating influences toward adaptation.

Raymond (1920*b*, p. 73) has pointed out that during Lower Cambrian times all trilobites, with the exception of the Agnostidæ and the Eodiscidæ, had small pygidia and were adapted only for crawling or floating. This state of affairs lasted throughout the Cambrian in the eastern portion of North America. However, in the Pacific seas three trilobite families with caudalized pygidia appeared in the Middle Cambrian, while another one appeared in the Upper Cambrian. In the Ordovician, caudalization reached a climax, and swimming types were developed all over the world, while the crawling ones with small pygidia disappeared. Raymond explains this change as due to the rise of predatory cephalopods and fishes, the natural enemies of trilobites, which, being initiated in the Pacific realm, rendered existence impossible except for the swimming forms.

Let us now consider the distribution of the Mesonacidæ. The only genera of this family that are well known and that are seen in great abundance in many parts of the world are *Mesonacis* and *Olenellus*. It should herewith be mentioned that hardly any of the European members of this family are found in sufficient abundance to permit generalization. The most abundant and the best known types for this purpose are found only in North America. On this continent it is evident that *Mesonacis* predominated in the Pacific seas, whereas *Olenellus* did so in the Atlantic waters. *M. gilberti*, *M. claytoni*, *M. bristolensis*, *M. robsonensis*, *M. insolens*, *M. canadensis*, and *M. argentus*, are abundant in the west, whereas *M. vermontana*, the only eastern form of this genus, is rarely ever seen. In contrast with this genus, *Olenellus* is abundantly represented in the Lower Cambrian of eastern North America by *O. thompsoni*, whereas *O. truemani* and *O. logani*, the western species of this genus, are comparatively rare. We have already seen that in structure *Mesonacis* is further advanced from *Olenellus*. When it is remembered that straight cephalopods and other newcomers appeared first in the Pacific seas and further stimulated adaptation by their presence, it is not surprising that we should here find that *Mesonacis* rather than *Olenellus* was abundant; on the other hand, the latter was still the more abundant of the two in the quieter waters of the Atlantic. Indeed, the eccentric segments of *M. robsonensis* are not unlikely the result of unsuccessful caudalization, while the secondary fusion of the sutures may be an adaptation for burrowing.

Concerning this fossil, Burling (1916, p. 54) writes: "The fourth, fifth and sixth pleuræ on the right side of the specimen described have suffered injury, being broken off close to the axis at such a time or in such a manner that the ends have healed, and show a tendency toward normal termination. The fifth one in particular is broken clear across, and in it the pleural groove stops just inside of the newly curved margin; the fourth and sixth were broken across transversely so as to leave the greater portion respectively of the upper and lower margins. This particular trilobite is as large or larger than the largest that has so far been discovered in the Lower Cambrian of British Columbia or Alberta. If we assume that the accident occurred during the youth of the trilobite, we must grant that these early forms did not have the power of renewing broken or lost portions, but this conclusion is negatived by its ability to heal up the broken ends and fashion them off. The accident was, therefore, probably of recent occurrence. And since it must have happened during his maturity, we are somewhat justified in assuming that our trilobite lost this portion of his anatomy to a foe more voracious, if not larger, than himself. The occurrence certainly lends weight to the inference that the Lower Cambrian trilobite was not the supreme arbiter we have supposed him to be; however,—he may have been struck by material dislodged from a ledge beneath which he was crawling."

As one would expect in the case of specialized animals, the Mesonacidæ probably left no descendants—certainly *Mesonacis* did not. Walcott considered that *Paradoxides* was descended from *Wanneria.* Indeed, this genus greatly resembles *Wanneria,* from which it differs only in being larger and in having a relatively larger and more specialized glabella, as well as usually more free segments in the thorax. The chief objection to this theory has been that *Paradoxides* with its well-defined facial suture could not have been descended from a mesonacid with its sutures secondarily fused. The difficulty of having to postulate the return of facial sutures in *Paradoxides* makes the descent of this fossil from the Mesonacidæ improbable. The relation of this genus to the Mesonacidæ is perhaps best explained as having been descended from a common ancestor (Raw, 1925, p. 309). It is also interesting to note that the specialized *Paradoxides* died out at the close of the Middle Cambrian and left no descendants.

Having seen that the Mesonacidæ were not closely related to the annelids, it now becomes apparent that their eccentric features, such as the fused sutures and the rudimentary segments of *Masonacis robsonensis,* are those of marked specialization. It is, therefore, remarkable that such an unusual type of trilobite as the Mesonacidæ should be found in the Lower Cambrian along with such dissimilar primitive forms as the Agnostidæ. However, this becomes easily understood when it is remembered that the former are end stages in the evolution of the benthonic types—soon to become extinguished—whereas the latter are primitive pelagic types that were destined to hold their own until the end of the Palæozoic era. The origin of the Mesonacidæ, therefore, becomes obscure and almost impossible to determine. Moreover, little can be learned from the study of their larval forms, since these, too, have specialized features—such as extra pairs of cephalic spines—that are not seen in the adults, but which are, nevertheless, merely features of adaptation (Raymond, 1928, p. 168; Raw, 1925, p. 322; Swinnerton, 1919, p. 109). Both Swinnerton (1919, p. 108) and Raymond (1928, p. 169) pointed out that no reliable conclusions could be arrived at from the study of the embryonic forms. It is for that reason that they have not been discussed in this paper

It may indeed be true that the unusually eccentric and degenerate features of some of the more advanced genera of the Mesonacidæ indicate an acceleration in the evolution of the animal kingdom brought about by the arrival of cephalopods and other new classes of animals. Specialization in the later benthonic trilobites does not appear to be so acute as in the Mesonacidæ, possibly indicating that the former merely had to compete with other animals that were already there but did not have to become adapted to a changing environment. Of course, this view is purely hypothetical and probably never can be satisfactorily proved. However, from what we have seen, it may be truly stated that both structural and developmental evidence show that the Mesonacidæ were highly specialized benthonic trilobites which afford no criterion indicating the evolution of arthropods from annelids, inasmuch as this family is far removed from any relationship with the latter.

BIBLIOGRAPHY

BEECHER, C. E. 1897. 'Outline of a Natural Classification of the Trilobites.' Amer. Journ. Sci., (4) III, No. 14, Art. VIII, pp. 89–106.

BERRY, E. W. 1929. 'Palæontology,' New York.

BURLING, L. D. 1916. '*Pædeumias* and the Mesonacidæ with Description of a New Species, having at least 44 Segments, from the Lower Cambrian of British Columbia.' Ottawa Nat., XXX, pp. 53–58.

GRABAU, A. W., AND SHIMER, H. W. 1910. 'North American Index Fossils,' Vol. II, New York.

HALL, J. 1859. 'Trilobites of the Shales of the Hudson River Group.' Ann. Rept. N. Y. State Cab. Nat. Hist., XII, pp. 59–62.

1860. 'Note upon the Trilobites of the Shales of the Quebec Group in the Town of Georgia, Vermont.' Ann. Rept. N. Y. State Cab. Nat. Hist., XIII, pp. 113–119.

1862. 'Supplementary Note to the Thirteenth Report of the Regents of the State Cabinet.' Ann. Rept. N. Y. State Cab. Nat. Hist., XV, p. 114.

JONAS, A. I., AND STOSE, G. W. 1930. 'Topographic and Geologic Atlas of Pennsylvania.' Penn. Geol. Surv., 4th Ser., No. 168, 'Lancaster Quadrangle,' pp. 1–106.

PARKER, T. J., AND HASWELL, W. S. 1928. 'A Text-book of Zoölogy,' Vol. I, 4th Ed., London.

RAW, F. 1925. '*Leptoplastus salteri* and other Trilobites.' Quart. Journ. Geol. Soc. London, LXXXI, pp. 223–324.

1927. 'Ontogenies of Trilobites and Their Significance.' Amer. Journ. Sci., XIV, No. 78, pp. 7–35; No. 80, pp. 131–149.

RAYMOND, P. E. 1917. 'Beecher's Classification after Twenty Years.' Amer. Journ. Sci., XLIII, Art. 23, p. 196–210.

1920*a*. 'The Pygidium of the Trilobite.' Geol. Mag., LVII, pp. 22–25.

1920*b*. 'The Appendages, Anatomy, and Relationship of Trilobites.' Mem. Conn. Acad. Arts and Sci., VII, pp. 1–169.

1928. 'Ontogenies of Trilobites.' Amer. Journ. Sci., XV, No. 86, pp. 168–170.

Resser, C. E. 1928. 'Cambrian Fossils from the Mohave Desert.' Smithson. Misc. Coll., LXXXI, No. 2, pp. 1–14.

Swinnerton, H. H. 1915. 'Suggestions for a Revised Classification of Trilobites.' Geol. Mag., Dec. VI, Vol. II (N.S.), No. 11, Art. II, pp. 487–497; (continued in) No. 12, Art. II, pp. 538–545.

1919. 'The Facial Suture of the Trilobite.' Geol. Mag., Dec. VI, Vol. XI (N.S.), No. 3, Art. II, pp. 103–110.

1923. 'Outlines of Palæontology,' London.

Walcott, C. D. 1885. 'Paleozoic Notes; a New Genus of Cambrian Trilobites.' Amer. Journ. Sci., XXIX, pp. 328–330.

1886. 'Second Contribution to Studies on the Cambrian Faunas of North America.' Bull. U. S. Geol. Surv., No. 30, pp. 158–180.

1891. 'The Fauna of the Lower Cambrian or *Olenellus* Zone.' Ann. Rept. U. S. Geol. Surv., X, Pt. I, pp. 509–774.

1910. '*Olenellus* and Other Genera of the Mesonacidæ.' Smithson. Misc. Coll., LIII, No. 6, pp. 231–422.

1916. 'Cambrian Geology and Paleontology.' Smithson. Misc. Coll., LXIV, No. 5, pp. 406–407, Pl. xlv.

Whitfield, R. P. 1884. 'Note on *Olenellus thompsoni* Hall." Bull. Amer. Mus. Nat. Hist., I, Art. 7, pp. 151–153 (see also Pl. xv).

Zittel, Carl von. 1913. 'Textbook of Palæontology,' Eastman Ed., Vol. I, pp. 692–729.

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NEW CROCODILIAN REMAINS FROM THE HORNERSTOWN MARLS OF NEW JERSEY

By Charles C. Mook[1]

INTRODUCTION

In March, 1929, fossil bones were found by men working in the marl pits of the Permutit Company at Birmingham, New Jersey. The discovery was reported by Mr. Vaugh, Manager of the Permutit Company's plant at Birmingham, to Dr. H. B. Kümmel, Director of the State Conservation Department and State Geologist. The matter was referred by him to Mrs. Katherine Greywacz, Curator of the State Museum at Trenton. Arrangements were made for the excavation of the bones, and a party headed by Mr. Charles Lang, of the American Museum of Natural History, proceeded with this work. They were provided with facilities by Mr. Vaugh and by Mr. McPherson, Superintendent of the plant. The bones were first exhibited in a partially prepared condition at the State Museum, and they were then sent to the American Museum, where they were completely prepared by Mr. Lang. The writer was given the opportunity of describing this material by Mrs. Greywacz.

The horizon in which the bones occurred is the lower fossiliferous level of the Hornerstown Marl. The Hornerstown was formerly considered uppermost Cretaceous. Recent investigation by the United States Geological Survey has determined the horizon to be Lower Tertiary. As the Hornerstown lies beneath known Lower Eocene formations, its age may be considered Paleocene.

The remains consist of portions of the skull and lower jaws, eighteen teeth, three cervical, one dorsal, one lumbar, two sacral, nine caudal vertebræ, right scapula, left coracoid, left humerus, right and left ulnæ, both ilia, both ischia, left pubis, both femora, both tibiæ, one metapodial, one tarsal, a partial sternal, ten ribs, and many dermal scutes.

A considerable number of genera and species of crocodilians have been described from the New Jersey Greensands. The type of one of these, *Gavialis fracterculus* Cope, occurred in the marl pits at Birmingham. It differs sufficiently in characters, however, from the specimen herein described to forbid its reference to that species. The resemblance is closest to *Holops pneumaticus* Cope, and the specimen is provisionally referred to that species.

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[1] Contributions to the Osteology, Affinities, and Distribution of the Crocodilia, No. 20.

SKULL

The skull is largely lacking in this specimen, only more or less fragmentary portions being preserved. From these fragments certain characters may be determined.

In the region of the cranial table the supratemporal fenestræ are large, being much larger than in *Holops brevispinis* Cope. The interfenestral bar is much narrower relative to the interorbital plate than in the latter species. In the specimen described, this bar is one-seventh as broad as the interorbital plate. In the *H. brevispinis* skull in the Rutgers Museum, it is about one-half the breadth of the interorbital plate. In the present specimen the interfenestral bar is deeply excavated, or rather its edges are rolled upward, and all the surficial pits have merged into one conspicuous depression. In the *H. brevispinis* skull the bar is flat and the pits on it are small and separate. In the present specimen the pits on the frontal, and on the parietal, both anterior and posterior to the interfenestral bar, are large and deep and close together. In the *H. brevispinis* skull they are small and shallow and far apart.

A considerable portion of the right maxillary is preserved. It is preserved from the alveolar border to the median line, and indicates that the rostrum was very slender. It was somewhat higher in proportion to its breadth than in the modern gavial or its Siwalik relatives. The inner border of the bone on its upper surface bends outward sharply a short distance from its anterior end. This indicates former contact with the premaxillary. A similar bending outward and backward at the posterior end indicates contact with the nasal. The straight portion along the median line indicates contact with the opposite maxillary. This portion is 105 mm. long, and lies opposite four maxillary teeth.

The alveoli of the teeth extend obliquely upward and backward in a regular curve, corresponding with a similar disposition in the modern gavial. These alveoli are larger than those of a modern gavial with a slightly larger skull. The curvature of the alveoli is somewhat greater than in the modern form. The alveolar border is slightly notched between the alveoli, but there is no suggestion of looping, either horizontal or vertical.

MEASUREMENTS

Right supratemporal fenestra, antero-posterior	57 mm.
Right supratemporal fenestra, transverse	66 est.
Breadth of plate between supratemporal fenestræ	11.5
Width of snout, minimum, estimated	54.0
Length of maxillary over four alveoli	93
Vertical height of mandible near external fenestra	92
Length of longest tooth preserved	63

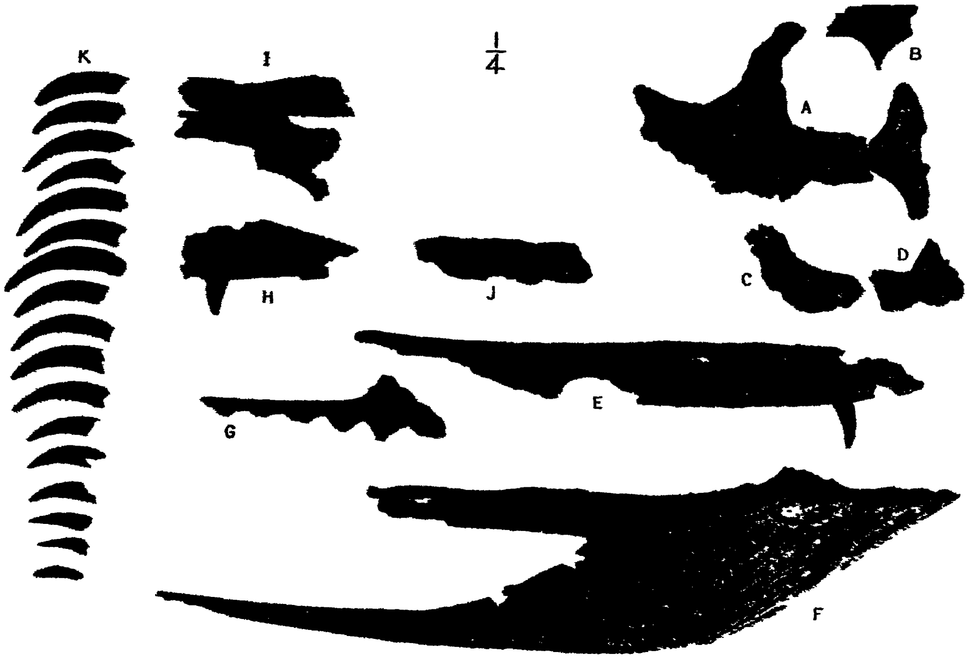

Fig. 1. *Holops pneumaticus* Cope. Specimen in New Jersey State Museum. All figures about one-fourth natural size.

A, cranial table, with parts of postorbital, frontal, and parietal bones, superior view; B, portion of right squamosal bone (?), superior view; C, portion of left postorbital bone (?), superior view; D, portion of left squamosal bone (?), superior view; E, portion of right maxillary bone, lateral view, right side; F, portion of left ramus of mandible, showing portions of angular, surangular, and articular bones; G, portion of left maxillary bone, inferior view; H, portion of left maxillary bone, external view; I, portions of nasal bones, superior view; J, fragment of maxillary, indeterminate as to position; K, isolated teeth.

Long, slender mandible with short symphysis. Amount of festooning very slight. Edges of alveoli of the first four mandibular teeth elevated somewhat above the alveolar border and are separated by considerable spaces from each other. The two first alveoli are near, but not at, the median line. Alveoli (1) are separated by a diastema of 9 mm. In order of diameter the alveoli are: 4–1–2–16–3–17–18. The rest of the alveoli are small. Each alveolus is complete, no two alveoli being confluent.

The symphysis extends backward to the level of the anterior borders of the fifth mandibular alveoli. On either side of the median line, anterior to the level of the fourth mandibular tooth, the superior surface of the dentary is somewhat depressed. In the depression are several pits, somewhat nearer to the alveolar line than to the median line. The shaft of each ramus is slender. There are 20 teeth in the lot. These vary considerably among themselves, yet show a certain amount of uniformity.

They are all relatively slender and are all considerably curved. They are circular or subcircular in section. None of the teeth has a very short crown, although the length is somewhat variable, along with the degree of curvature, probably in correlation with the position of the teeth in the dental row.

The teeth are all very slightly keeled. They exhibit varying degrees of striation, but in no case is striation prominent. Some of the striæ appear to be subparallel, converging toward the apex; other striæ are irregular and anastomosing rather than subparallel.

VERTEBRAL COLUMN

The vertebral column is represented by fifteen recognizable vertebræ, besides fragments of others. These consist of three cervicals, one dorsal, one lumbar, two sacrals, and nine caudals. These vertebræ present characters that are somewhat different from normal crocodilian vertebræ. The differences are minor in extent, however.

The first, or atlas vertebra, is represented by the centrum only. This, when viewed from above, is subrectangular in outline, contrasting with the subtriangular outline of *Crocodilus americanus*. The posterior surface is smaller than the corresponding surface in *C. americanus*, but the inferior surface is relatively larger.

	New Specimen	*C. americanus* A.M. 7139
Length of dorsal surface	38 mm.	27 mm.
Breadth of posterior surface	42	46
Height of posterior surface	24	25 (oblique)
Length of inferior surface	36	30

The seventh cervical is fairly well preserved, although the spine may not be complete. It was probably low. The prezygapophyses have moderately short, semi-oval articular surfaces, contrasting with long, subrectangular surfaces in the corresponding vertebra of *C. americanus*. The position of the articular surfaces is slightly nearer the horizontal than in the living form. The postzygapophysial surfaces are also rounder and flatter than in the recent species. The notch between the pre- and postzygapophysial processes is not so deep as in *C. americanus*. The anteroposterior diameter of the neural arch is greater than in the living species. The neural canal is decidedly larger than in the recent form.

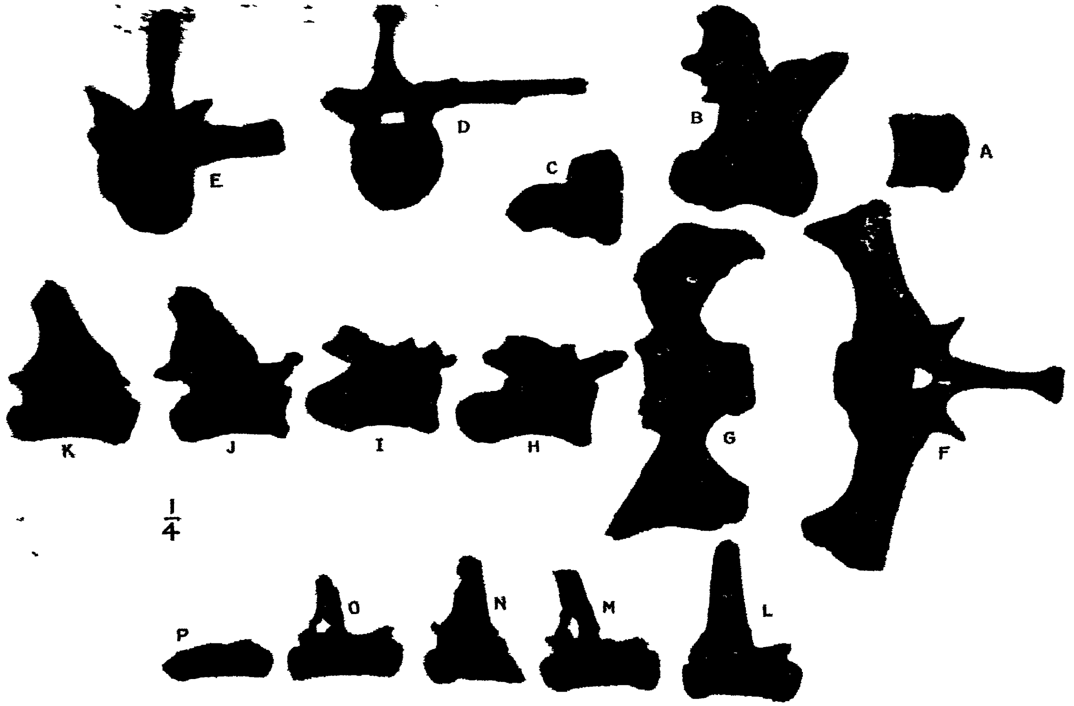

Fig. 2. *Holops pneumaticus* Cope. Specimen in New Jersey State Museum. All figures about one-fourth natural size.

A, atlas vertebra, inferior view; B, seventh cervical vertebra, lateral view, right side; C, eighth (?) cervical, lateral view, left side, inverted; D, fifth dorsal vertebra, anterior view; E, first lumbar vertebra, anterior view; F, first sacral vertebra, anterior view; G, second sacral vertebra, superior view; H, ninth caudal vertebra, lateral view, right side, I, eleventh caudal vertebra, lateral view, right side; J, thirteenth caudal vertebra, lateral view, right side; K, fourteenth caudal vertebra, lateral view, right side; L, sixteenth caudal vertebra, lateral view, right side; M, seventeenth caudal vertebra, lateral view, right side; N, eighteenth caudal vertebra, lateral view, right side; O, nineteenth caudal vertebra, lateral view, right side; P, twentieth caudal vertebra, lateral view, ght side

The diapophysial and parapophysial processes are much less robust than in *C. americanus*. On the inferior surface the spread of the parapophysial processes is slightly greater than in the corresponding vertebra of *C. americanus*. The hypapophyses are much less prominently developed than in the modern species. In the last two characters the vertebra resembles very closely the centrum of a corresponding vertebra of *Holops obscurus* (Am. Mus. Cope Coll. 2025).

The eighth cervical is represented by the lower portion of the centrum only. Its parapophysial processes correspond in relative size with those in *C. americanus*, but are shaped slightly differently. The hypapophysis is somewhat more prominent than that of C.7, but is less so than in *C. americanus*.

The fifth dorsal is moderately well preserved. The spine is long antero-posteriorly, but is short vertically. It is inclined backward to a considerable degree. The left diapophysial process only is preserved, and it is incomplete. It is long in the fore-and-aft direction, but was probably short transversely. The capitular facet is located about one inch from the external prezygapophysial border, or about the same distance as from the mid-line to the external prezygapophysial border. The tubercular facet is not preserved.

The pre- and postzygapophysial surfaces are relatively very small, and are nearly horizontal in position, contrasting with the large oblique zygapophyses of the corresponding vertebræ of *C. americanus*. The neural canal is relatively large, especially in the lateral dimension. The centrum is short antero-posteriorly, and is higher than it is broad.

The vertebra identified as presacral 2 (or lumbar 1) is moderately well preserved. The spine is incomplete, but enough of it is preserved to indicate that the spine was taller than that of the vertebra last described, and that it was long in the fore-and-aft direction. The right transverse process is missing, and the left one is incomplete. It is extended in the antero-posterior direction. As in the vertebræ already described, the pre- and postzygapophyses are small and are nearly horizontal in position. The neural canal is comparatively small. The centrum is relatively long and narrow, compared with the corresponding vertebra of *C. americanus*.

The first sacral vertebra is decidedly different from that of *Crocodilus americanus*. The spread across the transverse process is approximately the same as in the specimen of *C. americanus* used for comparison (Am .Mus. No. 7139). Other dimensions can therefore be compared for similarity or contrast. The vertebra as a whole is very lightly constructed. The spine is slightly shorter vertically than in *C. americanus* and is considerably shorter in the antero-posterior direction. The summit, however, is considerably expanded.

The prezygapophysial processes are slender. The zygapophysial surfaces are small compared with those of *C. americanus*, but are consistent in size with those of the presacral vertebræ. The left postzygapophysis only is preserved, but it is complete. Both the process and the surface are extremely small. The spread across the two postzygapophyses must have been less than one-third the distance across the prezygapophyses. In the corresponding vertebra of *C. americanus*, the spread of the postzygapophyses is over half that of the prezygapophyses.

The transverse processes are extremely slender. Their distal expansions are relatively as great, compared with the shafts, as in *C. americanus*. The area of the distal expansions, however, in about one-third of that in the latter species.

The centrum is much shorter anteroposteriorly than in the living form.

The second sacral is less well preserved than the first. The spine is missing, except at the base. The prezygapophysial region is incomplete, but enough is preserved to indicate the small size of the prezygapophyses themselves. The right postzygapophysis is preserved. It is relatively larger than the prezygapophysis. The postzygapophysial surface is considerably smaller than in *C. americanus*, and is nearly horizontal in position. The spread of the two postzygapophyses was slightly less than that of *C. americanus*.

The transverse processes are approximately as long as in the recent form, but are extremely slender in comparison. The vertical diameter of the right process is scarcely one-half that of the recent species, and the distal surface, for articulation with the ilium, is less than one-half that of the latter. In both anteroposterior and transverse diameters the centrum is slightly smaller than in *C. americanus*.

The most anterior caudal preserved in the series appears to be Cd. 9. In it the spine is largely missing, but appears to have been long in the antero-posterior direction, judging from the base. The prezygapophysial processes are long and slender. They overhang the centrum farther than in *C. americanus*, and have a greater transverse spread. This may be partly due to the effects of pressure after burial, but not entirely so, as the base is but slightly asymmetrical, and shows no fracturing. The prezygapophysial surfaces are small in comparison with *C. americanus*, and are more nearly horizontal in position. The transverse processes are incomplete, and their bases are not distinctive.

The centrum is long and slender. Its vertical diameter is somewhat less than in *C. americanus*, especially at the posterior end. The border of the anterior cup is nearly vertical, compared with the oblique border in *C. americanus*. The posterior ball of the centrum is more decidedly convex than in the latter species, and the chevron facets are smaller.

The caudal identified as Cd. 11 is slightly smaller than Cd. 9. The spine is not preserved. The zygapophyses are incomplete, but indicate a narrower spread and smaller facets than in the modern form. The pit between the postzygapophyses is narrower than in Cd. 9. The transverse processes are represented by broken bases only; these are not distinctive.

Caudal 13 has a moderately tall spine, that is long in the anteroposterior direction at the base. The right prezygapophysis only is preserved. The process is slender, and the surface is small. The left postzygapophysis and part of the right one are preserved. The articular surfaces are small and close together. The centrum is short in the anteroposterior direction, being about two-thirds the length of the corresponding vertebra in *C. americanus*. The transverse processes are not preserved. The anterior articular surface of the centrum is relatively large, and moderately concave. Its vertical dimension is slightly greater than in *C. americanus*. The upper part of this surface is narrower than in the living species, but the lower part is broader. The whole surface is less triangular. The posterior surface is very convex. This convexity occupies the entire end of the centrum, and not merely part of it as in *C. americanus*. The inferior surface of the centrum is relatively much broader than in the American crocodile. The ridges that bound it laterally are higher, and the depression between them is deeper.

Caudal 14 has a tall spine that tapers more rapidly than that of Cd. 13. The zygapophyses are not preserved sufficiently well to permit description. The trans-

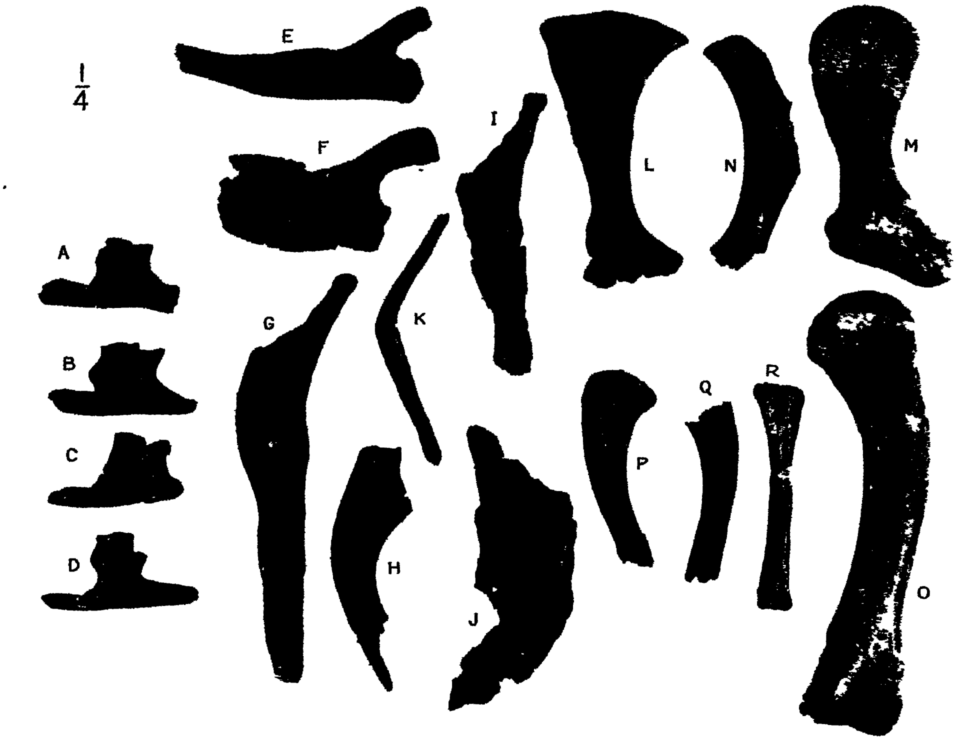

Fig. 3. *Holops pneumaticus* Cope. Specimen in New Jersey State Museum. All figures about one-fourth natural size.

A, right fourth cervical rib; B, right seventh cervical rib; C, left fourth cervical rib; D, left seventh cervical rib; E, left first dorsal rib; F, left third dorsal rib; G, right fifth dorsal rib; H, right third dorsal rib; I, right sixth dorsal rib; J, right fourth dorsal rib; K, sternal rib; L, right scapula; M, left coracoid, N, left scapula; O, left humerus; P, right ulna; Q, left ulna; R, metapodial.

verse processes are not preserved. The length of the centrum is the same as in Cd. 13. The anterior surface of the centrum resembles that of Cd. 13, except that it is not so high. The inferior surface of the centrum resembles that of Cd. 13, except that the lateral ridges are not quite so high, and are somewhat closer together.

The caudal identified as 16 is incomplete. It has a tall, slender spine, which is supported laterally by a pair of laminar braces; and it has no transverse processes, but smooth bone at the point usually occupied by the bases of these processes. The zygapophyses are not preserved. The centrum is poorly preserved. It appears to be about three-fourths the length of the corresponding vertebra in *C. americanus*, and somewhat narrower and lower. The lateral ridges of the inferior surface are close together.

Caudal 17 is fairly complete. The spine is high and slender. The prezygapophyses and postzygapophyses are not preserved. The centrum is of moderate length, and the ridges of its inferior surface are close together.

The caudal identified as 18 has a high slender spine with lateral braces The zygapophyses are not preserved. The centrum is narrow, and the two ridges of the inferior surface are close together. This vertebra is considerably smaller than the corresponding one in *C. americanus.*

Caudal 19 has a very slender spine, whose summit is incomplete. The zygapophyses are not preserved. The centrum is very slender.

Caudal 20 is represented by the centrum only.

A centrum represents what is probably Caudal 20. It resembles the centrum of Cd. 19, but it is slightly smaller.

LIMB AND GIRDLE BONES

The right scapula is preserved, though its proximal, or lower, border is incomplete; a portion of the left is also present. The distal blade differs considerably in shape from that of the Recent American crocodile. The superior border of the blade is long, as in *Crocodilus americanus*, but the blade narrows rapidly, while in *C. americanus* it narrows gradually. The anterior border is straighter than in the compared Recent species, and the posterior border is more regularly concave. The shaft is thicker than in the American crocodile. The lower, or proximal, end of the bone is not complete, but enough of it is preserved to exhibit the bases of the processes strengthening the glenoid articulation.

The left coracoid is present, though its borders are incomplete. Its preservation does not permit accurate determination of its characters, excepting that it is clear that the shaft of the bone is flatter and less thick than in the American crocodile.

The left humerus is nearly complete. It is curved slightly more than the humerus of *C. americanus* and exhibits some different proportions. The outline of the head, viewed from above, is suboval, rather than irregularly pentagonal. The upper portion of the anterior aspect of the bone, between the head and the deltoid crest, consists of one surface, contrasting with two distinct surfaces making an oblique angle with each other, as in *C. americanus.*

MEASUREMENTS

	Height of vertebra, entire.	Breadth across prezygapophyses.	Breadth across postzygapophyses.	Length, right prezygapophysis to right postzygapophysis, inclusive.	Breadth across diapophyses.	Breadth across parapophyses.	Length of centrum.	Breadth of centrum, anterior end.	Height of centrum, anterior end.	Breadth of centrum, posterior end.	Height of centrum, posterior end.
Cervical 7	....	59	55	70	68e	64	68	48	43	43	36
Cervical 8	....	....	....	....	....	....	....	51	42	....	....
Dorsal 5	....	70e	70e	65e	212e	130e	64	44	47	38	35
Lumbar 1	132	60	57	82	124	....	68	46e	44	38	34
Sacral 1	110	73	20e	60e	215	....	51	58	37	42	31
Sacral 2	....	....	51	55e	181	....	55	41	27	52	33
Caudal 9	....	42	34	71	....	....	62	37	38	31	30
Caudal 11	....	....	23	69e	....	....	66	33	34	29	28
Caudal 13	92e	28e	19e	67e	. .	..	63	29	30	26	26
Caudal 14	100e	....	19e	61e	....	. .	63	29	27	29	20
Caudal 16	90e	....	....	....	....	. . .	60e	23	23	....	....
Caudal 17	....	....	....	....	....	....	60	21	21	21	19
Caudal 18	....	....	....	....	....	....	....	....	....	20	17
Caudal 19	....	....	....	....	....	....	57	17	19	18	18
Caudal 20	....	..	....	....	....	....	54e	....	....	....	....

The head is relatively narrower in proportion to the length of the bone, compared with the modern form. The crest is somewhat less robust than in the American crocodile, and is relatively farther from the proximal end. The shaft is somewhat flatter in section than in the living American crocodile. The portion of the shaft below the crest is proportionately shorter than in *C. americanus*. The distal end is not completely preserved, but enough of it remains to enable one to note that it was comparatively narrow. The whole bone exhibits a much greater degree of curvature than is characteristic of the American crocodile.

Measurements

	C. americanus Am. Mus. No. 7139, left	New specimen
Length	28.1 cm.	24.9 cm.
Circumference of shaft	10.1	9.1
Index	359	365
Breadth across proximal end	7.0	5.8
Index	249	232
Breadth across distal end	6.5	5.4 est.
Index	231	176
Distance from tip of crest to center of head	70	70
Distance from tip of crest to distal end	226	193 est.
Ratio, superior portion over inferior portion	309	362 est.

Both right and left ulnæ are preserved but are not sufficiently complete to permit description of characters.

Both ilia are preserved; neither ilium is complete, but the left one is nearly so. It is not especially noteworthy in form, although the following items may be noted: it appears to be higher in proportion to its length than in *C. americanus*, though this cannot be proven definitely owing to the incomplete character of the posterior process. It is definitely higher in proportion to the distance across the pubic and ischiadic peduncles than in the living American crocodile. The excavations, on the internal side, for articulation with sacral ribs, are not so deeply excavated nor so rugose as in *C. americanus*. This may be partly due to the abrasion of the specimen.

They also differ somewhat in shape.

Both ischia are represented, but the right ischium is incomplete. The left ischium is practically perfect; the following description is based on this bone. The most noticeable characteristics of the ischium are the relatively short length of the bone, and the great width of the neck below the superior articular processes. The inferior flange is relatively wide, the thickness of the neck and of the posterior iliac process is not great. The inferior border appears to have been regularly rounded, and not composed of two straight lines making an angle with each other, as in *C. americanus.*

	7139	
Length posterior iliac process to inferior border	174	129
Breadth across flange	109	103
Ratio, br. of flange over length	626	798
Breadth across both iliac processes	94	75
Ratio, breadth across iliac processes over length	546	581
Breadth of neck	31	41
Ratio, breadth of neck over length	672	318
Thickness of neck	19	16
Ratio, thickness of neck over length	109	124
Ratio, thickness of neck over breadth of neck	623	390

A pubic bone, apparently that of the left side, is included in the material, but it is not sufficiently well preserved to permit description.

Both femora are present in the specimen, but the distal end is lacking in each femur. This prevents the computations of accurate ratios depending upon the length of the bone. The left femur is the better preserved of the two, and the description is largely based on it.

The curvature of the bone is somewhat greater than in the femur of *C. americanus*, and the degree of twisting of the shaft is also somewhat greater. The head is much broader in proportion to its thickness than in the living American crocodile. The shaft appears to be smaller in proportion to its length than in the Florida crocodile.

	sp.	A.M. 7139
Length	300 mm. est.	330
Head to 4th trochanter	86	123
Breadth of head	63	65
Thickness of head	36	42
Circumference of shaft	103	115

The tibia is represented by both sides, but both specimens are too incomplete to permit accurate description.

The fibula is not preserved. One metapodial, without distinctive characters, is present.

RIBS

A number of ribs are present in various degrees of preservation. Some of them can be identified as to their place in the series, while others are indeterminate. Some of the ribs exhibit characters of considerable morphologic significance.

Four complete cervical ribs and part of a fifth are preserved. One pair evidently belonged to Cervical 4. The capitular facets are much

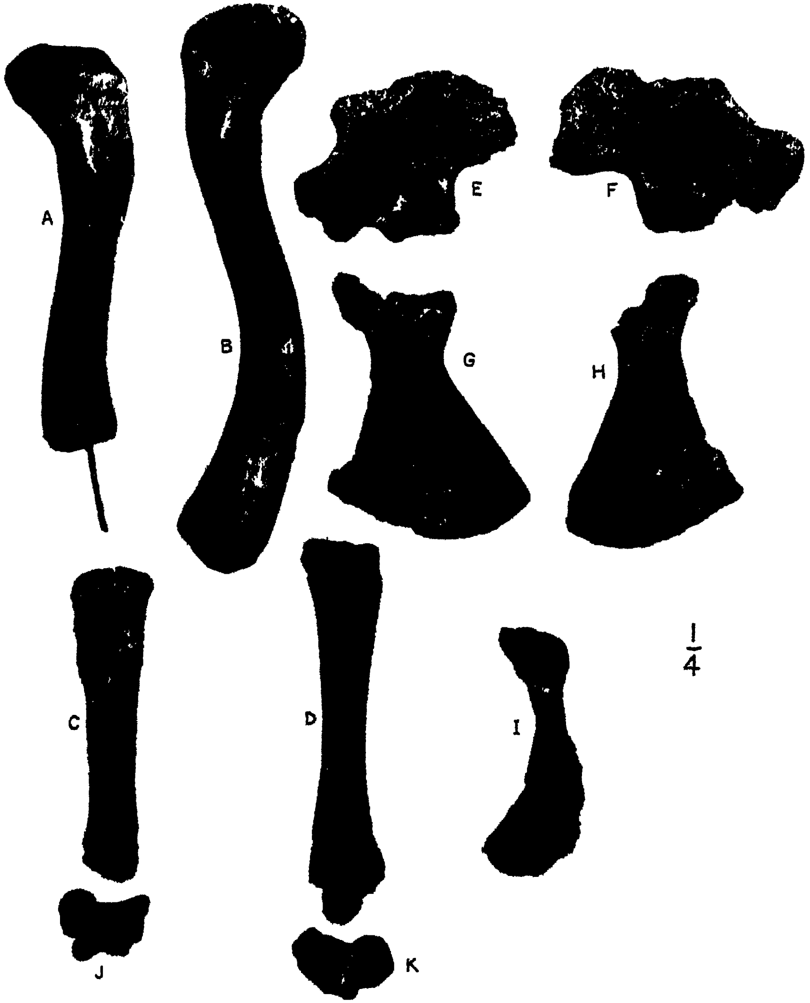

Fig. 4. *Holops pneumaticus* Cope. Specimen in New Jersey State Museum. All figures about one-fourth natural size.

A, right femur; B, left femur; C, left tibia; D, right tibia; E, left ilium; F, right ilium; G, right ischium; H, left ischium; I, left pubis; J, right calcaneum; K, left calcaneum.

larger than the tubercular facets. The anterior branch of the shaft is much shorter than the posterior branch.

The second pair, probably represents Cervical 7. The articular facets of these ribs are small compared with those in *C. americanus*. The chief distinction between the seventh cervical rib of the latter and those described is the fact that both the anterior and the posterior branches of the shaft are of equal length in *H. pneumaticus*, and their shafts are twisted, producing a deep excavation on the upper surface of the anterior branch, and another on the lower surface of the posterior branch.

A number of dorsal ribs are present. Six of these are identifiable as left dorsal 1, right and left dorsal 3, left dorsal 4, right dorsal 5, and right dorsal 6. Other ribs are represented by fragments. All of these ribs are characterized by remarkably broad shafts, especially near their proximal ends. This breadth is so great that the successive ribs must have approached an overlapping condition. In fact some of the anterior ribs may actually have overlapped each other.

In the left first dorsal rib the tubercular facet is twice the size of the capitular facet. In *Crocodilus americanus* these facets are of equal size. The notch between the tubercular and capitular processes is less deep than in the living species. The external ridge appears to have been more prominent, and the whole proximal region is more stoutly constructed. The shaft tapers toward the distal end, but the end itself is not preserved.

The right third dorsal rib has a very large tubercular facet. Its length is about twice its breadth. In the American crocodile this facet is comparatively small, and is subcircular. The capitular facet, and the process on which it rested, are not preserved, but enough of the border of the notch between the tubercular and capitular processes is preserved to indicate that this notch was not very deep. The proximal portion of the shaft is very broad, but its thickness is not as great as in *C. americanus*. The distal end is not preserved.

The left third dorsal has both articular surfaces preserved. These surfaces are larger than the corresponding surfaces in *C. americanus*. They are situated on very stout processes; the notch between these processes is shallow. The shaft of the bone is very broad.

The left fourth dorsal is the broadest rib in the series, so far as it is known. The capitular facet is small. The tubercular facet is incomplete, but was probably of moderate size. These facets are not on elevated processes but rather on the shafts of the bone; there is little notching between them. The shaft is excessively broad. It represents the maximum breadth known among crocodilians.

The right fifth dorsal rib has moderately large, subequal articular facets. They differ from those of the American crocodile in being oval instead of circular. The capitular facet is situated directly on the shaft, and not on a process of its own. The tubercular facet is situated on a process that may be considered as an extension of the main shaft of the bone. This process is in direct line with the long axis of the shaft, and not oblique to it as in *C. americanus*. The shaft of the bone is very broad; but it is also rather thin. The tapering toward the distal end is very gradual. The end itself is not preserved.

The right sixth dorsal rib is more slender. The facets are of moderate size. The tubercular facet is concave. The shaft is broad, but not extremely so. It turns upward slightly on the posterior border.

Measurements

Left Cervical 2.	
Length of both branches of shaft	73 mm.
Center of shaft to tubercular facet	44
Right Cervical 7 (The left Cervical 7 is distorted).	
Length of both branches of shaft	80
Center of shaft to tubercular facet	44
Left Dorsal 1.	
Breadth across both articular facets	56
Breadth of shaft at proximal end of external crest	32
Thickness	10
Right Dorsal 3.	
Maximum breadth of shaft incomplete as preserved	43
Thickness, maximum	17
Left Dorsal 3.	
Breadth across both articular processes	77
Maximum thickness of shaft	53
Thickness, maximum.	17
Right Dorsal 5.	
Distance across both articular facets	70
Breadth of shaft, maximum	44
Thickness	10
Left Dorsal 4.	
Breadth across articular facets	62 preserved 75 estimated when complete
Breadth of shaft	55
Right Dorsal 6.	
Breadth across both articular facets	61
Breadth of shaft	37

DERMAL SCUTES

Sixty-two fairly complete dermal scutes are preserved, besides fragments of others. These vary in outline from subcircular to square to rectangular. They are all moderately thin, they all lack median keels, and their pitting is deep and irregular.

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59.7, 56 N (729.6)

A NEW SOLE FROM THE BAHAMAS

By J. R. Norman[1]

In 1928, Nichols and Heilner[2] described and figured a rare sole from the Bahamas, which had been identified as *Gymnachirus nudus*, Kaup. Chabanaud's[3] description of the type specimen of Kaup's species, published in the same year, left little doubt that the Bahamas specimen must belong to another species. Through the kindness of Mr. J. T. Nichols, this fish (Amer. Mus. Nat. Hist. No. 9591) was sent to me on loan, and it proves to belong to a hitherto undescribed species which may be known as **Nodogymnus nicholsi**, new species.

The genus *Nodogymnus*, Chabanaud,[4] may be readily distinguished from *Gymnachirus* by the presence of two pelvic fins which are fused together, and by the absence of teeth. Two species have thus far been recognized: namely, *N. fasciatus* (Günther) from an unknown locality, and *N. zebrinus* Ribeiro from Rio de Janeiro. The single known specimen of the first of these is in the British Museum, and I have examined a rather poorly preserved example of *N. zebrinus* received from Mr. Miranda Ribeiro. The Bahamas sole differs from both species in having no trace of a pectoral fin on the ocular side; it may be further distinguished from *N. fasciatus* by the much less convex anterior profile and different coloration, and from *N. zebrinus* by the narrower cross-bars on the body.

Descriptions and figures of soles from Florida and Masschusetts, respectively identified as *Gymnachirus fasciatus* and *G. nudus*, were published by Kendall[5] in 1911, and in 1916 Nichols[6] described a new *Gymnachirus* (*G. melas*) from North Carolina. These appear to have been overlooked by Chabanaud in his valuable revision of the subfamily Achirinæ.

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[1] Assistant Keeper, Department of Zoology, British Museum (Natural History).
[2] 1928, Amer. Mus Novit., No. 326.
[3] 1928, Bull. Inst. Océan. Monaco, No. 523, p. 37.
[4] *Op. cit.*, pp. 30, 50.
[5] 1911, Proc. U. S. Nat. Mus., XL, p. 201.
[6] 1916, Bull. Amer. Mus. Nat. Hist., XXXV, p. 71.

AMERICAN MUSEUM NOVITATES

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597.58 L (67.5)

A NEW *LAMPROLOGUS* FROM LAKE TANGANYIKA

By J. T. Nichols and F. R. LaMonte

The Museum has recently received a small collection of cichlid fishes from Lake Tanganyika, Africa, obtained by Dr. William K. Gregory and Mr. H. C. Raven at Uvira, Lake Tanganyika. Several of the interesting genera peculiar to that lake, specimens of which were previously lacking from our collections, are contained therein, but the only new form is represented by a single small species of *Lamprologus* which presents certain tangible differences from anything previously described, and which we think justifies adding it to the several small species of that genus already recognized from Lake Tanganyika.

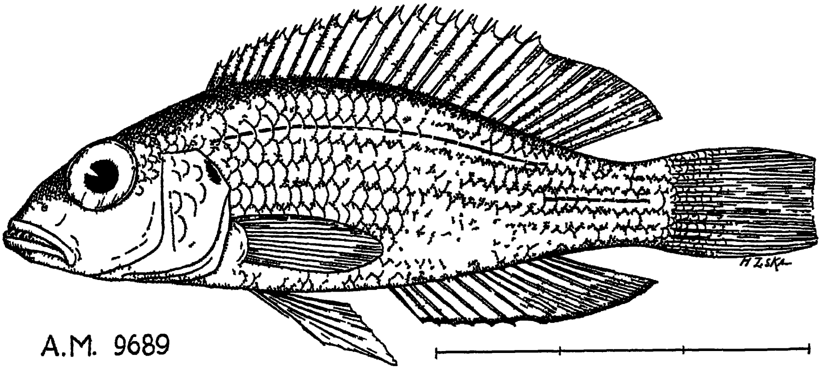

Fig. 1. *Lamprologus finalimus*, type.

Lamprologus finalimus, new species

Description of Type.—No. 9689, American Museum of Natural History.

Length to base of caudal, 45 mm. Depth in this length, 3.2; head, 3.2. Eye in head, 3.2; snout 3.2; interorbital, 4; maxillary, 2.5; greatest width (at shoulder), 2.1; depth of peduncle, 2.8; its length, 2; pectoral, 1.4; ventral, 1.5; last dorsal spine, 2.2; longest ray, 2; last anal spine, 2.1; longest ray, 2; caudal, 1.5.

Dorsal, XVIII, 9; anal VII, 8. Scales, 37; lateral lines 25+9. Teeth small and conical, about 6 larger teeth in the front of each jaw; gill-rakers on lower part of anterior arch, 9 or 10.

Moderately compressed, the back evenly arched, and the ventral outline only slightly arched. Lower jaw projecting; mouth slightly oblique, maxillary to under front of eye. Gill-rakers rather long and slender. Pectorals rounded, not extending as far backward as the ventrals which are pointed and reach the anal origin. Caudal truncate. Scales strongly denticulate, present on opercle but apparently lacking on jaws, snout, interorbital, cheek, and breast. Basal half of caudal well scaled. In alcohol the specimen is brownish with a narrow dark edge on the upper part of the opercle. Body with faint pale longitudinal stripes in the center of the scales, alternating with darker ones. Dorsal with faint oblique pale bars extending downward and slightly backward. Anal with a black margin.

This seems to be a small species, more or less allied to *L. calliurus* and *L. reticulatus*. It has fewer gill-rakers than *calliurus* and disagrees otherwise with descriptions of that species. It is not *reticulatus*, with which we have compared it, and its gill-rakers are much longer than in species allied to *L. mondabu*.

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NEW SPECIES OF *DINOGAMASUS* (*DOLAEA*), SYMBIOTIC MITES OF CARPENTER BEES FROM THE ORIENTAL TROPICS

By Norma LeVeque[1]

Mites of genus *Dinogamasus* Kramer (*Dolaea* Oudemans) of the Oriental tropics appear to fall into a few rather distinct groups which correspond with the grouping of species of their hosts (or symbionts) of genus *Mesotrichia* (*Koptorthosoma*), carpenter bees.

In Novitates, No. 432, October 9, 1930,[2] I reported on two new species, *Dinogamasus philippinensis* and *D. piperi* from the Oriental tropics, which belong to the *perkinsi* group. These two species, as well as *perkinsi*, were taken from the abdominal pouch of mesotrichian bees of the *latipes-tenuiscapa* group, considered by Westwood to be carpenter bees of subgeneric rank, *Platynopoda*. The African species which I reported in Novitates, No. 434, October 14, 1930,[3] likewise fell into a few groups closely correlating with host relationships. In the present article it will be seen that there are other groups of mites correlating with the apparent subgeneric groups of carpenter bees with which these mites are so closely associated.

Holotypes are deposited in The American Museum of Natural History, New York City, and a set of paratypes will be at the National Museum, Washington, D. C. All figures have been drawn with the camera lucida but are not necessarily all of the same scale. The drawing of the mandible in all cases is of larger magnification.

Dinogamasus kerrianus, new species

Female.—Length: 1600μ–1900μ. Width: 960 μ–1100μ. Approximate length of legs: I, 1100μ; II, 1000μ; III, 1240μ; IV, 1500μ.

Dorsal shield leaves a narrow margin of soft skin from the third legs to posterior part of the body; just behind legs IV many specimens show a slight notch in the shield. Very fine, extremely short hairs are scattered over the shield and on the soft skin; they are somewhat more frequent in the shoulder region; two pairs of longer hairs are at the end of the shield.

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[1] University of Colorado.

[2] 'Two new species of *Dinogamasus*, mites found on carpenter bees of the Oriental tropics.'

[3] 'Mites of the genus *Dinogamasus* (*Dolaea*) found in the abdominal pouch of African bees known as *Mesotrichia* or *Koptorthosoma* (Xylocopidæ).'

Sternal shield, slightly rounding at posterior end, is 240μ wide and 200μ long. There are extra hairs on the shield besides the two pairs of sternal hairs. There is a tendency for the third sternal hairs and the metasternal hairs to be doubled. Stigmal plate large, measuring 200μ by 120μ. A peritrematalium is evident but due to poor chitinization it is impossible to describe it with accuracy. Genital shield 480μ long, sides almost parallel, but broadly rounding at posterior end, 180μ at greatest width. Anal shield 320μ by 220μ, 150μ at posterior end. Ventral surface of body around anal shield is almost bare except for approximately twelve hairs between anal shield and genital shield. Fixed digit of mandible as long as movable digit.

Coxal spines slightly inflated, sharply pointed, and all about same size. Hairs and cones on legs not especially strong. On patella I and tibia I there are three basal blunt cones; on tarsus I there are two basal and one midway blunt cone. Tarsus II has one blunt cone on basitarsus, a short round cone ventral, and a larger heavier cone outward and subapical.

HABITAT.—Abdominal pouch of *Mesotrichia kerri* Cockerell, from Doi Sutep (Chiengmai Mt.) Siam, collected by McKean; and from Ranawng, Siam, collected by Kerr.

Holotype, from Ranawng, Siam, measures 1700μ long, 960μ wide.

This species is similar to *Dinogamasus sternisetosus* (*Dolaea sternisetosa* Vitzthum), 1930, except for smaller size. (The measurements of *sternisetosus* are: length, 2120μ; width, 1700μ. Legs: I, 1240μ; II, 1140μ; III, 1535μ; IV, 1820μ.) Several specimens of *kerrianus* show an in-cupping of the dorsal shield in the region of the noticeable notch characteristic of members of the *perkinsi* group. Vitzthum says that this is not so with *D. sternisetosus* ("mit glatten, nicht 'benagten' Seitenlinien"). It is interesting to note that Ritsema in describing *Mesotrichia splendidipennis*, which is the host of *D. sternisetosus*, and that Cockerell in describing *M. kerri*, the host of *D. kerrianus*, made comparison of the bee with *M. tenuiscapa* of subgenus *Platynopoda*, the host-group of the *perkinsi* group of mites. Perhaps if other related species are found it will be seen that *sternisetosus* and *kerrianus* grade into the *perkinsi* group.

THE *Alfkeni* GROUP

Small to medium-sized mites; 1200μ to 1700μ long; central area of dorsal shield sparingly covered with a few pairs of hairs more or less symmetrically placed along the median line; sternal shield, wider than long, bearing two pairs of sternal hairs, the second pair near the posterior corners of the shield; metasternal hairs sometimes lacking; anal shield widest through anal opening which is usually two-thirds distant from posterior end of shield; peritrematalium usually discernible, slightly broadened at distal end; mandibles with fixed digit almost as long as movable digit; leg I with three basal and one midway-outer blunt cone on patella and tibia, with two basal and one midway-outer blunt cone on tarsus; leg II with one midway-outer blunt cone and two sharp ventral spines in a cross-row on patella and tibia, and with the three following structures on tarsus: one blunt cone on basitarsus, one blunt cone midway-ventral on apical segment, and a heavily chitinized clawed cone outward close to apex of segment.

GEOGRAPHIC RANGE.—India, Singapore, Siam, Philippine Islands.

HOSTS.—Asiatic *Koptorthosoma: Mesotrichia confusa, M. viridissima, M. bombiformis, M. philippinensis, M. ghilianii, M. trifasciata, M. chlorina, M. blüthgeni, M. cuernosensis.*

KEY TO SEPARATE NEW SPECIES OF *Dinogamasus* BELONGING TO *alfkeni* GROUP

1.—Metasternal hairs present, flanking anterior end of genital shield............2.
Metasternal hairs absent..3.
2.—Short hairs on body (about 40μ long on dorsal shield)...............*macgregori.*
Long hairs on body (160μ or longer on dorsal shield)...............*trihirtus.*
3.—Legs IV not as long as length of body.................................4.
Legs IV about as long as body...................................*longipes.*
4.—Length of body less than 1.5 mm.......................................5.
Length of body more than 1.5 mm................................*ramaleyi.*
5.—Dorsal shield broad, almost covering posterior end of body, long hairs more frequent on posterior lateral sides of body..................*concinnus.*
Dorsal shield more tapering at end, hairs quite evenly distributed around margin of body...6.
6.—Slightly smaller forms (measuring not over 800μ wide and not over 1360μ long). *alfkeni.*
Slightly larger forms (measuring from 800μ to 900μ wide and about 1460μ long). *similis.*

Dinogamasus alfkeni (Oudemans)

Greenia alfkeni OUDEMANS, 1902, Tijdschr. Entom., XLV, pp. 126–128.

Greeniella Alfkeni VITZTHUM, 1912, Zeitschr. wiss. Insektenbiol., (2) VIII, p. 94.

Dolaea alfkeni VITZTHUM, 1920, Arch. für Naturg., LXXXV (1919), Abt. A, Heft 5, pp. 8–10.

Dolaea alfkeni VITZTHUM, 1930, Zoolog. Jahrb., LIX, pp. 343–345.

This species has been variously described and figured. Dr. Oudemans very kindly sent me several specimens labeled "from *Koptorthosoma æstuans* (L.), Singapore, October, 1900, J. D. Alfken" (without doubt it is really *Mesotrichia confusa*), from which I made comparisons with specimens from *M. confusa* (Pérez) which has been so frequently confused with *æstuans*. It may be noted also that Vitzthum has well figured and redescribed *D. alfkeni* in the 1930 publication. He records *alfkeni* from *M. confusa* from Sumatra and Java, and from *M. coronata* (Smith) from "Tenimber-Inseln (Molukken)."

I have *D. alfkeni* from *M. confusa* from Singapore and also from Sikkim, India (from the Bingham collection, Berlin Museum; the latter specimen may not have the correct locality label).

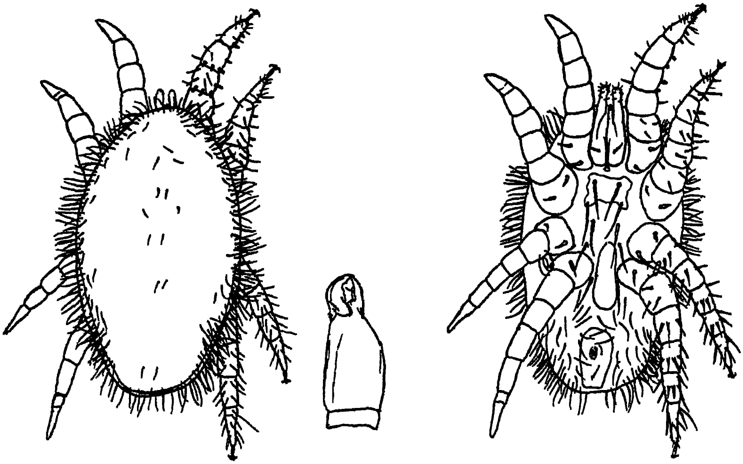

Fig. 1. Dinogamasus concinnus

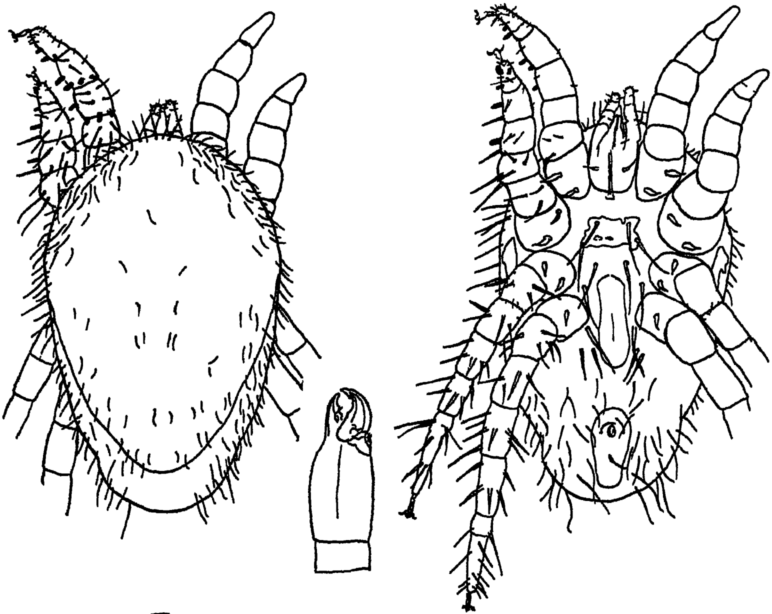

Fig 2. Dinogamasus ramaleyi

Dinogamasus concinnus, new species

Figure 1

FEMALE.—A member of *alfkeni* group. Length: 1400μ–1450μ. Width: 780μ. Legs: I, 900μ; II, 760–800μ; III, 900μ; IV, 1100μ.

Anterior end and posterior end of body broadly rounding yet somewhat truncated. Dorsal shield broadly rounding at end, almost covering body. Body margined with many long hairs about 180μ long, which are especially numerous on sides posterior to legs IV. Dorsal shield almost bare throughout whole central area except for some twenty hairs, 80μ to 100μ long, extending down the median line, usually two abreast.

Sternal shield with concave posterior margin, bearing the second pair of sternal hairs on the acutely angled corners. Third pair of sternal hairs 140μ apart; the metasternal hairs are 120μ apart and are not as heavy as the sternal hairs. The pair of genital hairs is about as heavy as the third sternal hairs. Genital shield is 380μ long and 140μ wide near the posterior end. Anal shield is 300μ long by 200μ wide, 120μ at posterior margin. The unpaired hair is nearer to the posterior margin than to the anal opening. A few long slender hairs, from 150μ to 200μ long, are scattered over the ventral surface back of legs IV. Fixed digit of mandible about as long as movable digit.

HABITAT.—Pouch of *Mesotrichia bluthgeni* Dusmet, from Mati Davas, Mindanao, Philippine Islands; collected by R. C. McGregor.

Dinogamasus similis, new species

FEMALE.—A member of *alfkeni* group. Length: 1460μ. Width: 800μ–900μ. Legs: I, 900μ; II, 800μ; III, 880μ; IV, 1000μ.

Similar to *D. alfkeni;* distinguishable mainly by its larger size and by the fact that the hairs on the dorsal shield are from 80μ to 100μ long, while those on *alfkeni* are about 50μ or 60μ long.

HABITAT.—Pouch of *Mesotrichia chlorina* Cockerell, from Manila, Philippine Islands; and a smaller sized race of *M. cuernosensis*, from Culasi, Panay, and from Naga, Cebu Island, Philippine Islands.

Holotype from *M. chlorina*, Manila.

Dinogamasus ramaleyi, new species

Figure 2

FEMALE.—A member of *alfkeni* group. Length: 1650μ–1800μ. Width: 920μ–1000μ. Approximate length of legs: I, 1000μ; II, 880μ; III, 1250μ; IV, 1480μ.

Greatest breadth of body between legs II and III; dorsal shield from vicinity of stigmal plates leaves a margin of soft skin around posterior end of body. The central area of shield is bare except for six pairs of rather symmetrically placed hairs about 80μ long; the border of the shield near legs I and II is covered with hairs from 100μ to 160μ long; the few hairs on the posterior part of the shield and soft skin are about 80μ long while three or four at the posterior end are 200μ long.

Sternal shield thinly chitinized, irregularly eroded, usually bearing two pairs of sternal hairs, though the second pair may sometimes be on isolated pieces of the shield. Third pair of sternal hairs is as widespread as the first pair. The genital

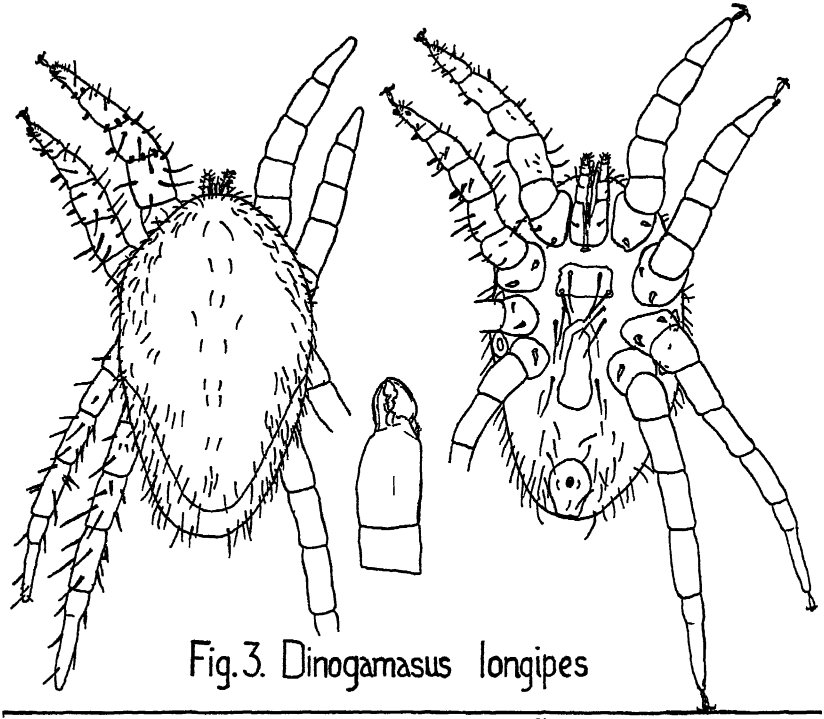

Fig. 3. Dinogamasus longipes

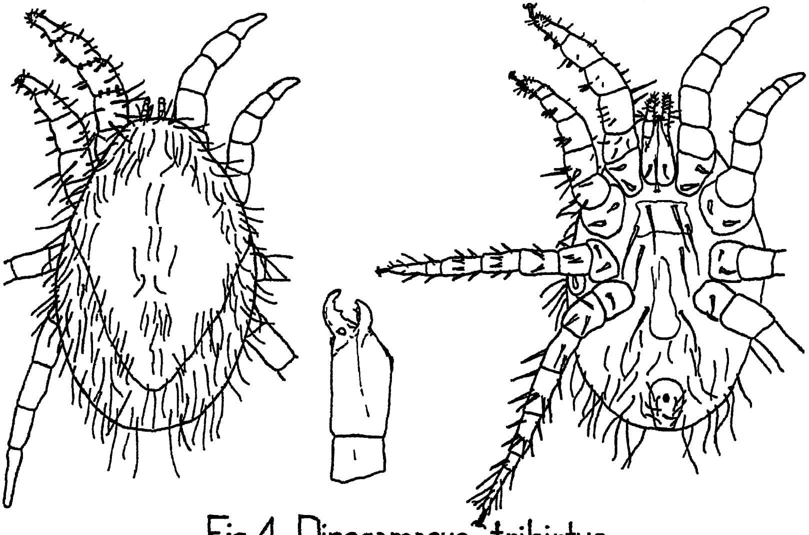

Fig. 4. Dinogamasus trihirtus

hairs are close to the posterior-inner margin of coxæ IV, flanking the genital shield, which is 400μ long by 130μ wide, the sides almost parallel, the posterior margin smoothly rounding. Two pairs of long hairs not as heavy as the genital pair flank the end of the shield.

Anal shield is 380μ long by 180μ at the greatest width. About thirty soft hairs are scattered over the soft skin surrounding the shield. The stigmal plate measures 130μ by 110μ; the peritrematalium, about 220μ long, is irregularly hatchet-shaped.

Legs have characteristic features of members of *alfkeni* group. The coxal spines are enlarged and sharply pointed. The ventral side of leg I bears only weak rudimentary hairs, the dorsal side has the usual longer hairs and four blunt cones on patella and tibia, and three blunt cones on tarsus. Leg II has long soft hairs on the dorsal side; patella II and tibia II have each a sharp spine basal-outward, a blunt cone outward-midway and two sharp spines ventral; tarsus II has a blunt cone outward on basitarsus, a short blunt cone ventral nearer apex and an enlarged claw-like cone outward at the apex.

HABITAT.—Pouch of *Mesotrichia bombiformis* (Smith), from Manila and Casiguran, Tayabas, Philippine Islands; *M. philippinensis* (Smith), from Manila; also larger race of *M. cuernosensis* Cockerell, from Culasi, Panay, and from Uling, Cebu, Philippine Islands; all collected by R. C. McGregor.

Holotype from *M. bombiformis*, Manila. Length: 1700μ. Width: 980μ.

Dinogamasus longipes, new species

Figure 3

FEMALE.—A member of *alfkeni* group. Length: 1580μ. Width: 880μ. Legs: I, 1000μ; II, 1020μ; III, 1300μ; IV, 1520μ.

Dorsal shield leaves a narrow margin of soft skin from legs II to end of body. Hairs, 100μ to 120μ long, are scattered in a more or less symmetrical arrangement through the median line of the shield; approximately four rows border the shield and soft skin of the body. Among these hairs on the margin and at the posterior end are some hairs 200μ long.

Sternal shield, wider than long, bears the first two pairs of sternal hairs. The third pair of sternal hairs is almost as far apart as the metasternal hairs.

Genital shield is 160μ at posterior end by 380μ long.

Stigmal plate is 120μ by 80μ. The peritrematalium extends forward 220μ.

Anal shield is 260μ by 190μ. The unpaired hair is midway between the anal opening and the posterior end of the shield. The few hairs scattered on the soft skin around the anal shield are about 100μ or 120μ long.

The legs possess the characteristic features of the *alfkeni* group: one midway-outer and three basal blunt cones on patella I and tibia I; one midway-outer and two basal blunt cones on tarsus I; one midway-outer blunt cone on patella II and tibia II; one outer on basitarsus, one rather distal-ventral, and one heavy subapical blunt cone outward on tarsus II.

Mandibles: fixed digit almost as long as movable one.

HABITAT.—Pouch of *Mesotrichia viridissima* (*M. confusa viridissima* Cockerell) from Trong, Siam. (Science, LXXI, pp. 607–608, June 13, 1930.)

Dinogamasus trihirtus, new species

Figure 4

FEMALE.—A member of *alfkeni* group. Length: 1400μ. Width: 820μ. Legs: I, 1000μ; II, 800μ; III, 1100μ; IV, 1240μ.

The body is widest in the region of the stigmal plates; the vertex of the body is more or less truncate; the posterior part smoothly rounding. The dorsal shield leaves a rather wide margin at the posterior part of the body from the region between legs II and III. Four or five rows of soft hairs about 200μ long border the entire body; a few hairs at the posterior end are 300μ long. In the central bare area of the anterior half of the body are four pairs of symmetrically placed long soft hairs; the posterior third of the shield has several long soft hairs merging into the longer marginal hairs.

The sternal shield, thinly chitinized, bears the first two pairs of sternal hairs; the anterior hairs are 120μ apart, the third pair of hairs 150μ apart. The metasternal pair is absent, the species thereby differing from most others of the *alfkeni* group.

The genital shield is 400μ long by 140μ wide at the widest part near the rounding posterior end. The pair of genital hairs flanks the posterior third of the shield. A few hairs about 120μ long are on the soft skin near the anal shield. Anal shield is 230μ long by 150μ at the greatest width (90μ wide at posterior end). The anal hairs are about 140μ long; the unpaired anal hair is midway between the anal opening and the posterior end of the shield.

Stigmal plate is 100μ by 120μ; there is a faint suggestion of the peritrematalium commonly present in this group.

Legs I and II have the usual features of the *alfkeni* group.

HABITAT.—Pouch of *Mesotrichia trifasciata* Gribodo, from Mati, Davao, Mindanao, Philippine Islands; collected by R. C. McGregor, 1927.

Dinogamasus macgregori, new species

Figure 5

FEMALE.—A member of *alfkeni* group. Length: 1500μ. Width: 820μ. Legs: I, 920μ; II, 850μ; III, 980μ; IV, 1200μ.

Dorsal shield tapers to a rounding point near posterior end of body, leaving a margin of soft skin posterior to legs II. Soft hairs, from 80μ to 100μ long, border the anterior fourth of the margin of the body and are scattered over the soft margin of the body and on the lateral margin of the posterior two-thirds of the shield; there are six or eight hairs ranging from 160μ to 200μ long at the posterior extremity of the body; through the median line of the dorsal shield there is a sparse sprinkling of short hairs rather symmetrically placed.

Sternal shield wider than long, 240μ by 160μ, bears the first two pairs of sternal hairs. The space between the first pair of sternal hairs is 140μ; between the second, 180μ; between the third, 120μ. The metasternal hairs are lacking as in *D. trihirtus*. Genital shield 360μ long by 120μ wide. Genital hairs as heavy as the sternal pairs.

Anal shield is 240μ long by 200μ wide, the base measuring 120μ. The few hairs surrounding the shield vary in length, some being about 60μ long, while three or four pairs which flank the shield are 200μ long. The lateral margin of the posterior part of the body has only a few short hairs.

Stigmal plate is 120μ by 190μ. Peritrematalium margining the outer side of stigmal plate extends forward 240μ, forming a sort of double-axe or irregular hatchet-shaped shield.

Mandible rather typical of the group except that teeth are not very prominent.

Coxal spines slightly inflated; those posterior on coxæ I, II, and III are the larger ones. Legs have the structures characteristic of the *alfkeni* group.

HABITAT.—Pouch of *Mesotrichia ghilianii* Gribodo, from Samar, Philippine Islands, collected by R. C. McGregor, 1924; also from a specimen of *M. ghilianii* from Iligan, Mindanao, Philippine Islands.

Holotype from Samar, Philippine Islands.

Although this species agrees with *D. trihirtus* in lacking the metasternal hairs, it may be distinguished from it by the shorter hairs of the body.

The Latin description of *Dinogamasus* (*Dolaea*) *jacobsoni* (Berlese), 1910, is so meager that it is practically impossible to recognize the species. The host is recorded as *Mesotrichia* (*Xylocopa*) *æstuans* (Linnæus). It is puzzling to know if the bee was determined correctly, since *æstuans* is exotic to tropical Asia. The host may have been the native *M. confusa* Pérez which *æstuans* so closely resembles, or it may have been some species closely allied to *confusa*, since the symbiont is not *D. alfkeni* (which Berlese said he had seen); *D. alfkeni* is the species found on *M. confusa*.

Mesotrichia æstuans, which is endemic to Africa, has been found in the Palearctic region of northern India. These specimens of *æstuans* from India bore characteristic African mites of the *braunsi* group.[1] Accordingly, it is possible that *æstuans* has reached the tropics through the trade routes and is found in Java. If this is the case, then the species which I found in *æstuans* from Suez, Africa, and from Chikar Kot, Northwest Province, and from Jammu, Kashmir, and which I named *D. inflatus*, must be *D. jacobsoni*. On the other hand, if the host is a tropical Asiatic form, *M. confusa* or allied to *confusa*, the species of mite doubtless belongs to the *alfkeni* group. *D. jacobsoni* could hardly be the species which Vitzthum[2] took from *M. cærulea* Fabricius, which species and its allies are so different from the other carpenter bees that it is conceded that they belong to a subgenus, if not to a separate genus, *Cyaneoderes* Ashmead. Thus, I believe that Vitzthum is mistaken in his recent assumption concerning *D. jacobsoni*.

The species of *Dinogamasus* which I took from *Mesotrichia cærulea* is especially characterized by eight blunt cones on patella I. This fact

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[1] LeVeque, 1930, Science, LXXI, pp. 607–608.

[2] Vitzthum, 1930, Zoologische Jahrbücher, LIX, pp. 346–349, Figs. 40 and 41.

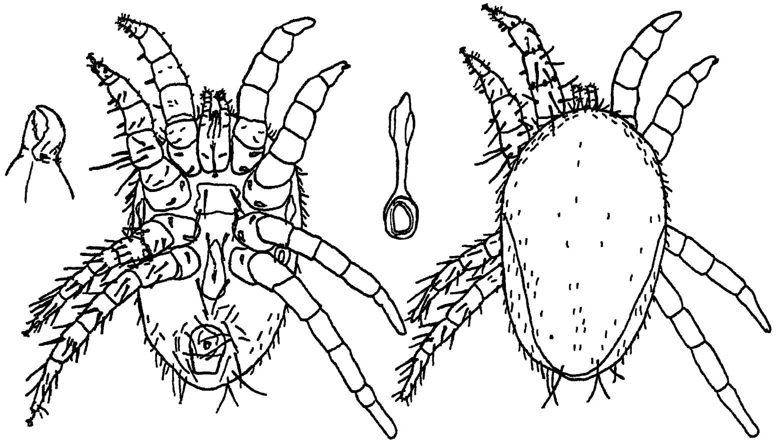

Fig. 5. Dinogamasus macgregori

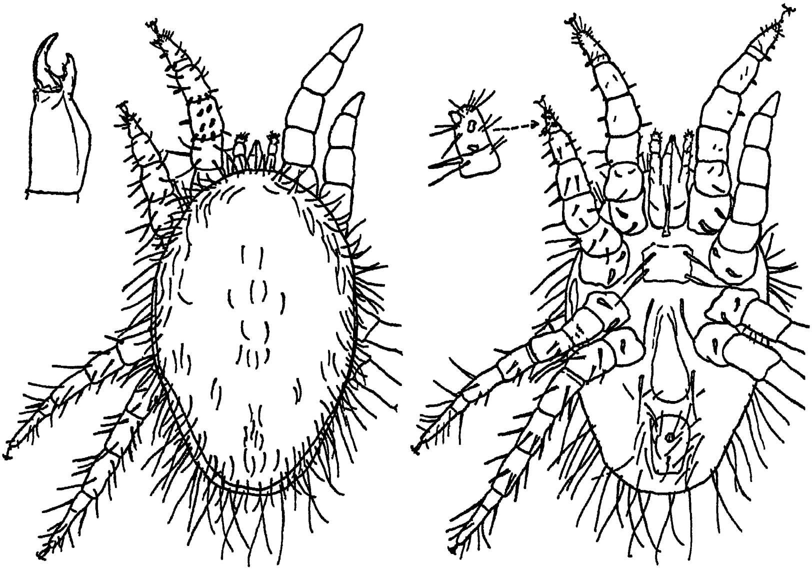

Fig. 6. Dinogamasus octoconus

has suggested the new specific name *octoconus*. *D. octoconus* has also been found on *M. abbottii* Cockerell.

THE *Octoconus* GROUP

The members of the *octoconus* group thus far examined are characterized by the following features:

Medium-sized mites; 1400μ to 1500μ long; dorsal shield with about six pairs of hairs more or less symmetrically placed along the median line, followed by a group of hairs which merge into the marginal hairs; sternal shield subrectangular, wider than long, bears two pairs of sternal hairs, the second pair near the posterior corners; anal shield somewhat wider through anal opening; peritrematalium usually poorly chitinized, thus difficult to see; fixed digit of mandible about three-fourths the length of the movable digit; leg I with eight blunt cones dorsal on patella, of which three are basal, one midway-outer, and four dorsal; tibia with three basal blunt cones and one midway-outer blunt cone; tarsus with two basal blunt cones and one midway-outer blunt cone; leg II has usually three short blunt cones on the tarsus.

GEOGRAPHIC RANGE.—Siam, Java, Singapore.

HOSTS.—*Mesotrichia cærulea*, *M. abbottii*, *M. dormeyeri*, all of subgenus *Cyaneoderes* Ashmead.

Dinogamasus octoconus, new species

Figure 6

Same as *Dolaea jacobsoni* as described by Vitzthum, 1930, being from the same host, *Mesotrichia cærulea*, and corresponding with Vitzthum's figures of "*jacobsoni*." (See discussion above, wherein it is considered not to be *D. jacobsoni* Berlese, 1910.)

FEMALE.—Length: 1500μ to 1700μ. Width: 900μ to 1000μ. Legs: I, 1100μ; II, 980μ; III, 1250μ; IV, 1450μ.

Dorsal shield covers most of the back but leaves a very narrow margin of soft skin lateral to coxæ II, III and IV, followed by a wider margin posterior to legs IV. Long, soft, finely pointed hairs are found around the margin of the body on the shield and on the soft skin; many of these marginal hairs are 300μ long. The large central bare area has a pattern of a few pairs of hairs scattered somewhat symmetrically through the median area, followed by an irregularly double row of hairs at the median posterior part of the shield which merge into the marginal hairs of the shield.

Sternal shield 200μ wide by 140μ long; slightly emarginate; bears two of the three pairs of long, heavy sternal hairs. Metasternal hairs lacking.

Genital shield broadly rounding posteriorly, 480μ long, 180μ at greatest width near posterior end, anterior margin often indistinct. The pair of genital hairs is almost as heavy as the sternal hairs.

Anal shield measures 300μ by almost 200μ. Unpaired anal hair usually midway between anal opening and posterior margin of shield. About twenty-four soft hairs approximately 180μ long are near the anal shield; the lateral surface of skin posterior to coxæ IV is bare. Hairs of margin of body are long, some being 350μ long.

Stigmal plate broadly oval, 140μ long by 120μ wide. Peritrematalium, indistinct on many specimens, extends forward 260μ, being 50μ wide at distal spread.

Leg I: ventral, three or four very fine, short, rudimentary hairs on each segment; dorsal, six heavy, soft, long hairs on femur, eight blunt cones on patella, besides one short stiff spine on inner basal margin, and one shorter, very fine hair midway on inner side of patella; on tibia, four blunt cones, three of which are basal, the other one midway on outer side, also four moderately long hairs on dorsal side, two fine rudimentary hairs on inner side; on tarsus, two basal blunt cones, one of which is more dorsal, the other being outwardly directed, and another blunt cone midway on outer side, besides several fine hairs, some short, others longer, on apical half of segment.

Leg II: three short hairs ventral on trochanter, also a spine on each side; femur has three slightly stronger hairs ventral, one long spine-like structure midway on outer side, two very fine short hairs on inner side, and three or four long hairs dorsal; on patella and tibia, three spine-like hairs midway, the outer one of which is longest, also one shorter, spine-like hair basal on outer side, five hairs dorsal on patella, four dorsal on tibia; tarsus not as long as tibia; basitarsus bears on outer side a spine which is occasionally modified as a blunt cone, also a slender spine median-ventral and close to basitarsus, a heavier blunt cone midway to the apex, and a thicker blunt cone outward-subapical; there are also several long fine hairs on the tarsus.

Legs III and IV: the usual spine-like hairs on all segments, with a few long softer hairs on outer and dorsal side of tibia and tarsus.

HABITAT.—Pouch of *Mesotrichia cærulea* (Fabricius) from Depok and Mt. Salak, Java, collected by Bryant and Palmer, 1909, and from Buitenzorg, Java; also from pouch of *M. abbottii* Cockerell from Trong, Siam, collected by Dr. W. L. Abbott.

Holotype from *M. cærulea* from Mt. Salak, Java.

Dinogamasus bakeri, new species

Figure 7

FEMALE.—A member of *octoconus* group. Length: 1460μ. Width: 860μ. Legs: I, 960μ; II, 840μ; III, 1100μ; IV, 1300μ.

Very similar to *D. octoconus*, especially in respect to arrangement and occurrence of hairs of margin and dorsal shield, and to number and occurrence of blunt cones, hairs and spines on legs, also in absence of metasternal hairs. Differs mainly in smaller size of body, length of legs, and in the following details: genital hairs are weak in comparison to sternal hairs, being only little larger than the ventral hairs around the anal shield; the ventral hairs are more numerous than on *octoconus*, there being forty or more around the shield; the longest hairs of the lateral margins are only about 160μ, those of the posterior margin about 200μ, while those of *octoconus* are longer, ranging from 200μ to 350μ. The sternal shield is very faintly chitinized. Anal shield: 260μ long by 160μ wide.

HABITAT.—Pouch of *Mesotrichia dormeyeri* Enderlein, from Singapore; collected by C. F. Baker.

Dinogamasus brevipes, new species

Figure 8

FEMALE.—Very similar to members of the *octoconus* group but differs from them mainly by having very short hairs on dorsal shield and around posterior margin of body, by having metasternal hairs present, and by having two blunt cones on tibia II as well as some spines on that segment. Legs III and IV are relatively short. Length: 1400μ. Width: 800μ. Legs: I, 800μ; II, 780μ; III, 880μ, IV, 940μ.

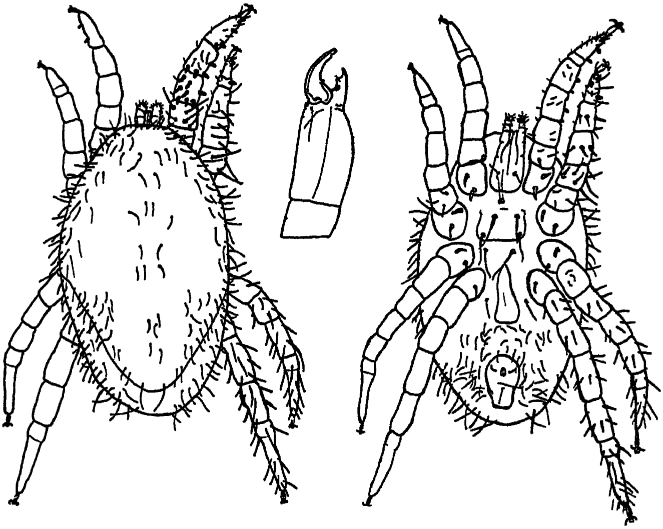

Fig. 7. Dinogamasus bakeri

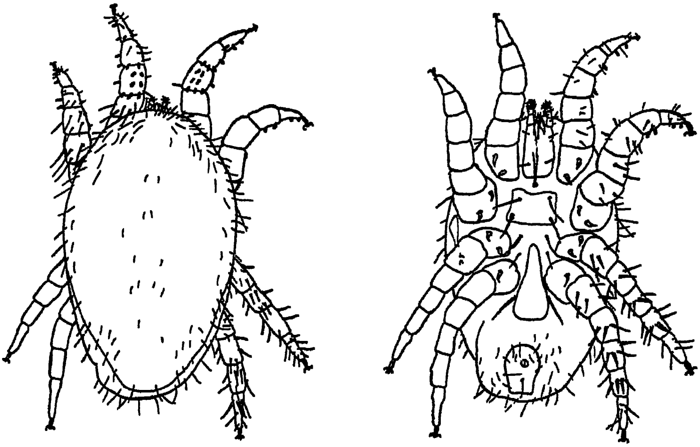

Fig. 8. Dinogamasus brevipes

Dorsal shield almost covers back; three or four rows of relatively long hairs around anterior fourth of shield, otherwise very few hairs on the margin of the shield or on the posterior margin of soft skin, though some of these are as long as 150μ; most of the few hairs of the posterior part of the dorsal shield are only 60μ long; there are eight or ten short, stiff hairs on the bare central area of the shield.

Sternal shield, 220μ wide by 190μ long, bears two pairs of sternal hairs, the second being very close to the margin of the shield. Third pair of sternal hairs 100μ apart; metasternal pair 150μ apart. Genital shield 370μ long by 160μ at greatest width near posterior rounding end. Anal shield, 300μ long by 180μ wide, surrounded by approximately twenty-four soft hairs.

Stigmal plate is 160μ by 110μ; peritrematalium extends forward 220μ.

Coxal spines large and inflated, except the one on coxa IV, which is quite slender.

Leg I: similar to that of *D. octoconus* with all ventral hairs weak and rudimentary; dorsal side of femur with customary long heavy hairs; patella with eight heavy blunt cones; tibia with three basal and one midway-outer blunt cone and fine rudimentary hairs at tip.

Leg II: trochanter bears three soft hairs ventrally; femur bears a short, heavy spine midway-ventral, two finer hairs outward-ventral, and four long hairs dorsal; patella has three sharp spines in a cross-row midway on outer side, four dorsal moderately long hairs, one basal-inner spine; tibia has one basal-outer and one midway-outer blunt cone, two midway-ventral spines which with the midway-outer blunt cone makes three structures in a cross-row, also four fine dorsal hairs; tarsus very short (basitarsus is about as long as distal segment of tarsus) has a blunt cone near junction of basitarsus about midway on tarsal segments, a short inflated finely pointed hair midway ventral near basitarsus, a short blunt cone ventral and another heavier one outward near apex of segment, and has the usual fine hairs at the tip of the segment, some of which are almost as long as the segment.

Legs III and IV: relatively shorter than those of most species of *Dinogamasus*.

HABITAT.—Pouch of *M. sinensis* (Smith), from Shin Kai Si, Mt. Omei, Szechwan, China; collected by D. C. Graham, 1923 (U. S. National Museum).

This species is very similar to *D. octoconus* and *D. bakeri* by having eight cones on patella I, but differs particularly in having the metasternal hairs present and by having two blunt cones on tibia II. The host does not belong to subgenus *Cyaneoderes*; thus the presence of the eight cones on this mite may be more a point of convergent resemblance than of natural relationship to members of the *octoconus* group.

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BEES OBTAINED BY PROFESSOR CLAUDE R. KELLOGG IN THE FOOCHOW DISTRICT, CHINA, WITH NEW RECORDS OF PHILIPPINE BOMBIDÆ

By T. D. A. Cockerell

Foochow or Fuchow, in southern China, is on the coast of the province of Fokien, a short distance north of the latitude of the northern end of Formosa. The Fokien Strait, about a hundred miles across, separates Formosa from the mainland. Owing to the industrious collecting of Sauter, the bees of Formosa are much better known than those of the adjacent mainland. Wallace, in his "Island Life," discusses the fauna of Formosa with special reference to the mammals and birds. He shows that in both groups the island possesses many endemic forms, and that these are frequently allied to species of remote regions, such as India, rather than with those of China. Thus he says of the birds: "This list exhibits to us the marvellous fact that more than half the peculiar species of Formosan birds have their nearest allies in such regions as the Himalayas, South India, the Malay Islands, or Japan, rather than in the adjacent parts of the Asiatic continent. Fourteen species have Himalayan allies, and six of these belong to genera which are unknown in China. One has its nearest ally in the Nilgherries, and five in the Malay Islands; and of these six, four belong to genera which are not Chinese. Two have their only near allies in Japan." The bees for the most part are closely allied to Chinese species, with the exception of certain species, such as *Andrena formosana* Cockerell, which must come from the mountains. The Formosan bee-fauna, as we know it, appears to be essentially a lowland fauna, and there can be little doubt that careful collecting in the high mountains (in the north reaching 12,000 feet) would produce a series of entirely new species. These would doubtless be found related to those of the Himalayas, the interior of China, or Japan. When we are trying to estimate the amount of divergence which has occurred since the separation of Formosa, it is necessary to consider the lowland fauna. The high mountains, prior to separation, were isolated from other similar ranges and must have had a largely endemic fauna. On the basis of the lowland fauna, Formosa, AS AN

ISLAND, does not impress us as being very ancient, and yet it is old enough to have produced a good many divergent types, and to be without rather numerous species which now abound on the adjacent mainland. For the student of Fokien bees, one of the most interesting problems is this comparison with Formosa, throwing light on the rate of divergence in different genera, and the former composition of the Fokien fauna. Indeed, what we find among the bees may readily be paralleled in other groups of insects. Take for example the butterfly *Papilio castor* Westwood: it has races in Sikkim (Himalayan Region), Assam, Burma, Siam, the Malay Peninsula, Hainan, and finally one (*formosanus* Rothschild) in the hills of Formosa. Among the bees, the races have not been so carefully studied as in the case of the butterflies, the material available being much less and the students very few. In several cases, we do not know whether the Formosan type is a race distinct from that of the mainland, good series from both regions being necessary. It is to be hoped that the coming years will see collectors of these insects in Asia, who will work with these interesting problems in mind, instead of merely collecting here and there with no definite purpose. It is unfortunate that there is no manual which describes the Chinese bees, but at present they are so little known that a synopsis of the recorded species would be extremely inadequate. There would be some utility in a compilation of the existing descriptions, like Mrs. Oldroyd's work on the Californian marine Mollusca, if any institution could be found willing to print it.

The bees recorded below, including the holotypes, are in The American Museum of Natural History.

MEGACHILE

Megachile faceta Bingham

One female. It has red tegulæ, as also is the case with *M. faceta* from near Shanghai.

Megachile faceta rufojugata, new subspecies

MALE.—Length, 11 mm.; parallel-sided, black, including mandibles, tegulæ and long antennæ; eyes very dark brown; head ordinary, cheeks broad, with a strong posterior margin; clypeus exposed, densely rugosopunctate all over, with a little shining spot in middle of upper end, lower margin unmodified, but from beneath it is a very conspicuous fringe of long white hair; sides of face and front covered with long bright fox-red hair; vertex densely rugose; cheeks strongly punctured, the punctures more or less running into grooves; thorax practically nude above, the mesothorax strongly punctured but shining between the punctures; scutellum convex, very densely rugosopunctate; area of metathorax moderately shining; a band of bright fox-red hair across prothorax to and including tubercles; a large patch of white hair behind wings; wings dark fuliginous, pale at base; basal nervure arched, falling short of nervulus; second cubital cell long, receiving recurrent nervures equally far from base and apex; legs with thin pale hair; anterior coxæ with small dentiform projections, not to be called spines; anterior tarsi simple; abdomen shining and strongly punctured, without hair-bands except at sides, where rudiments of white bands appear, on fifth tergite more extensive, occupying the lateral thirds; sixth tergite with a depression above, the keel rounded and without teeth; hair of venter white.

Nearest to *M. faceta* Bingham, but distinguished by the black tegulæ and non-metallic abdomen. It is, I think, best regarded as a subspecies of *M. faceta*.

Megachile tsingtauensis Strand

One female in rather poor condition, agrees so nearly with Strand's description that I cannot undertake to separate it. It is hardly 11 mm. long (Strand says 12), but the abdomen is contracted, and the wing measurement agrees with Strand's. The hair of the thorax above, and especially the scutellum is clear bright fox-red, whereas Strand says dark brownish-yellow. The ventral scopa is shining silvery-white, black on the last two sternites; Strand says silver gray-whitish, black at end. The antennæ are entirely black, and the tegulæ are clear ferruginous. Considering the locality, it is very possible that this should be separated from Strand's *M. tsingtauensis*, but it would not be prudent to do this without more evidence. It is a species of tropical affinities, allied to *M. metallescens* Cockerell from the Philippine Islands, and *M. subignita* Cockerell from Singapore, but with wholly non-metallic abdomen, different mandibles, etc. According to Miss Sandhouse, the type of *M. robbii* Ashmead is really *M. metallescens*, and Ashmead's name has priority. Ashmead's description makes no reference to the metallic abdomen, and his account of the ventral scopa: "long and dense, and tinged with yellow," is not at all applicable.

Megachile takaoensis Cockerell

Both sexes of this species, originally described from Formosa.

Megachile bicolor caldwelli (Cockerell)

Both sexes. *M. bicolor kagiana* (Cockerell) was based on males from Formosa; the female, from the same island, was named *M. bicolor taiwana* Cockerell. Father Piel wrote me that when he was at the U. S. National Museum, he and Miss Sandhouse could not separate males of

M. caldwelli from those of *kagiana*. I was not then able to make any comment, having no male of *M. caldwelli*. This deficiency now being remedied, I have reviewed the matter, and conclude that *M. caldwelli* and *M. kagiana* are both races of the Indian *M. bicolor* (Fabricius), separable on the characters of the females, as previously described. The middle femora of the male *M. caldwelli* are entirely black, whereas in male *M. bicolor* (*M. fletcheri* Cockerell) they are red in front.

Megachile rixator Cockerell

A female in bad condition, and a male *M. aspernata* Cockerell, not quite typical. These names were based on Formosan material; Hedicke has claimed that *aspernata* is the male of *rixator*, and it must be said that the present material supports that opinion.

Megachile abluta Cockerell

One female. Described from Formosa.

Megachile conjuncta Smith

Both sexes of this well-defined species.

Megachile dinura Cockerell

Both sexes; rather smaller than the type (♀, 16.5–18.5 mm. long), with white bands on abdominal tergites two to five.

The following table separates the above species:

1.—Abdomen appearing red, from a covering of red hair......................2.
Black species with pale hair at base of abdomen and on hind part of thorax...5.
Small ordinary species with abdominal hair-bands...................... 9.
2.—Males... 3.
Females... 4.
3.—Anterior tarsi dark, simple; sixth tergite tricarinate.....*takaoensis* Cockerell.
Anterior tarsi pale, broadened; sixth tergite not tricarinate, but with a strong median projection above.............. *bicolor caldwelli* (Cockerell).
4.—Clypeus depressed or chanelled in middle; mandibles above with a strong forked carina.............................. *bicolor caldwelli* (Cockerell).
Clypeus not depressed in middle; mandibles without such a carina.
takaoensis Cockerell.
5.—Females...6.
Males...7.
6.—Mesothorax polished, abdomen metallic................*conjuncta* Smith.
Mesothorax dull or rugose; large species................*dinura* Cockerell.
Mesothorax very rugose; red hair about tubercles..........*faceta* Bingham.
7.—Clypeus all dull and granular; small species; tubercles with red hair.
faceta rufojugata Cockerell.
Clypeus glistening; abdomen sub-metallic.............................8.

8.—Hair at sides of thorax fulvescent; abdomen coarsely punctured. *dinura* Cockerell.
Hair at sides of thorax white........................*conjuncta* Smith.
9.—Male; anterior basitarsi with a red boat-shaped process. *rixator* Cockerell (*aspernata* Cockerell).
Females.................... ....10.
10.—Stigma very small, red; ventral scopa fulvous..... ....*rixator* Cockerell.
Stigma black or nearly so... ... .11.
11.—Basal nervure almost meeting nervulus; a light band in scutello-mesothoracic suture..*abluta* Cockerell.
Basal nervure falling far short of nervulus; scutellum with much red hair, and no hair-band in suture..........................*tsingtauensis* Strand.

The female *M. faceta* is not conspicuously pale-haired at base of abdomen, and could perhaps better form a separate category at the beginning of the table.

BOMBUS

Bombus trifasciatus Smith

Six workers.

Bombus geei nigribasis, new subspecies

Almost exactly like *B. latissimus* Friese, from Formosa, but with the malar space conspicuously longer, as in *B. geei* Cockerell from Kuling, Kiangsi. The female is very robust, about 27 mm. long, the abdomen 12 mm. wide, and appearing wider on account of the outstanding hair. The female has the first two tergites black-haired, and the hair on the remaining ones deep rich red. In the worker, three tergites are black-haired. (In female *latissimus* the first tergite and often more or less of the second are black-haired, the rest red-haired. The wings are yellowish hyaline, with an apical dusky margin not reaching the cells. Mandibles of female strongly tricarinate on outer side; quadridentate, the inner two teeth small; third antennal joint about one and a third longer than fourth; no trace of yellow hair at sides of base of abdomen in female or worker; middle and hind tibiæ and tarsi dark red, with bright red hair. There is a very close resemblance to *B. discrepans* Pendelbury, from peninsular Siam, but that has the hind basitarsus long and very much narrower. *B. ignitus* Smith, from Japan, also may be compared, but has black hair on middle and hind legs.

One female (type) and twelve workers.

The type of *B. geei* is stated to be a female, but I think it is a large worker. In one *nigribasis* worker the hair at end of abdomen is fulvous rather than red, and there is a little fulvescent hair along apical margin of first tergite. There is also a worker with much white hair in middle of scutellum, and the hair of middle and hind tibiæ pallid. In this specimen only the first two tergites are black-haired. I believe that these differences are only varietal. Friese found the Formosan *B. latissimus* so variable in color that he described and named three varieties.

Bombus rufocognitus, variety **nefandus**, new variety

Female (type) and workers with hair of apical part of abdomen all black. The wings are fuliginous and the thorax has rich ferruginous hair, with a black band between wings. The first two tergites have pale yellow hairs. The typical *B. rufocognitus* is from Suifu, Szechwan.

The above species may be separated by the following table:

1.—Hair of thorax above all black....................... *geei nigribasis* Cockerell.
Hair of thorax above light, with a black band between wings................2.
2.—Light hair of thorax yellow.............................. *trifasciatus* Smith.
Light hair of thorax ferruginous............... *rufocognitus nefandus* Cockerell.[1]

ANTHOPHORA

Anthophora dulcifera Cockerell

Both sexes, the male being new. The female was described from Keeling, China. The Foochow females differ by the hair of the thorax above being pale fulvous profusely mixed with black, hence not nearly so bright as in the type. The abdominal bands are bright bluish-green, shining. The male is extremely like that of *A. zonata* (Linnæus), as I have it from Formosa, but is larger and more robust, with brighter colored bands, while the clypeus is conspicuously longer, and the lateral black marks come to a point above, instead of broadening to the upper edge of clypeus. The face is creamy white, not at all distinctly yellow.

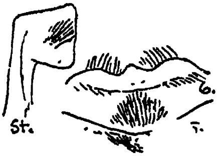

Fig. 1.

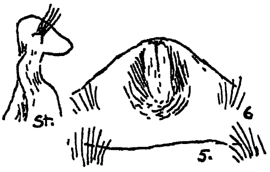

Fig. 2.

Fig. 1. *Anthophora dulcifera* Cockerell. Foochow district, China.
Fig. 2. *Anthophora zonata* (Linnæus). Takao, Formosa.

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[1] While on Oriental *Bombus*, I take the opportunity to record some material from the Island of Luzon, Philippine Islands. *B. mearnsi* Ashmead comes from Irisan, Benguet (McGregor), *B. irisanensis* Cockerell from Imugan (McGregor), Bontoc (Francisco Rivera), Zamboales Mts., Tapolao (McGregor), and Balite Pass, N. V. (McGregor). *B. baguionensis* (Cockerell) is from Benguet (McGregor) and Bontoc (Rivera). These Philippine *Bombus* are little related to those of China and Formosa. *B. irisanensis* belongs to Frison's subgenus *Senexibombus*, otherwise known from Sumatra and Borneo. *B. baguionensis*, however, is referred by Frison to the holarctic subgenus *Pratobombus*, and appears to have no relatives in Java, Sumatra, or Borneo. *Pratobombus* does occur (e.g., *B. flavescens* Smith in Chusan) in China, but so far as I know there is no species closely resembling that of the Philippines The male of *B. mearnsi* is unknown, and Frison does not undertake to place the subspecies generically; but it certainly shows resemblance to the group of *B. rufipes* Lepeltier (*Rufipedibombus* Skor.), which occurs in Java and Sumatra, but also in China and India. Although it is not much over 200 miles from Formosa to Luzon, and there are small islands between, the Philippine bee-fauna appears to be derived from other than Chinese or Formosan sources.

That *A. dulcifera* is really quite distinct from the Formosan *A. zonata* is shown by the fifth and sixth sternites, and the stipites, illustrated herewith. It is probably nearer to the Indian *A. cingulifera* Cockerell, and especially to **A. doveri**, new name (*A. walkeri nigritarsis* Dover, 1924, not *A. nigritarsis* Friese), which has quite the same sort of stipites. It agrees with *A. doveri* also in the black-haired hind basitarsi, but the white hair of hind tibiæ is not mixed with black, and the thoracic hair is quite different. My Formosa *A. zonata* agrees in the stipites with that species as illustrated by Dover (Entomologist, October, 1924). The seventh ventral plate of *A. dulcifera* is closely similar to that of *A. doveri*, not like that of *A. zonata*.

There is a possibility that the Foochow *A. dulcifera* are racially separable from the type, but it would take a good series from each place to prove it, and the color variation is such as we often see in *Anthophora*.

HABROPODA

Habropoda tainanicola (Strand)

The single female sent is in very bad condition, but it appears to belong to Strand's species, described from Formosa. It is very distinct by the entirely black face; the dark reddish labrum keeled down the middle and sharply bidentate at end; the large red area on basal part of mandibles; brownish-black hair of head and thorax (but cheeks below with long gray hair); dark tegulæ; yellowish-hyaline wings; hind tibiæ and tarsi covered with very bright ferruginous hair; apex of abdomen with red hair. If this is at all different from the Formosan insect, the fact can only be ascertained by direct comparison of good specimens.

CROCISA

Crocisa amata Cockerell

Two males. The species was described from Formosa. The Chinese form seems a little different, but not sufficiently so to deserve a subspecific name, at least until a good series can be studied. The hind femora of the male have a large tooth beneath.

Crocisa surda Cockerell

Two females. The species was described from Foochow (Caldwell).

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PLEISTOCENE MAMMALS OF FOSSIL LAKE, OREGON

By Herbert Oliver Elftman

The fauna of the Fossil Lake region of south-central Oregon has long been known as one of the largest faunas of the plains type in the Pleistocene of the West. Its importance is enhanced by the presence, in addition to numerous mammals, of over fifty species of birds and many species of fish. The birds have been described by E. D. Cope, R. W. Shufeldt and L. H. Miller, and the fish by E. D. Cope and D. S. Jordan. With the exception of the camels and the ground-sloth, described by Cope, and the muskrat, described by Hollister, the mammals have been referred to merely in faunal lists. The present paper is the result of study of the Fossil Lake material in the Museum of Palæontology of the University of California and in the American Museum of Natural History. Acknowledgment is gratefully made to Professor Chester Stock, under whose supervision the study was begun, and to the late Professor W. D. Matthew, Professor Joseph Grinnell and Mr. E. L. Furlong for generous assistance and advice.

LOCATION OF FOSSIL LAKE BEDS

Fossil Lake is situated in south-central Oregon in longitude 120° 30′ West and latitude of 43° 20′ North. To the southwest, and separated from it by a very slight elevation, are Christmas Lake, at a distance of five miles, and Silver Lake at twenty-five miles. In the literature some confusion exists as to the name of the fossil beds, Fossil Lake, Christmas Lake and Silver Lake being used, Fossil Lake seems to be the most appropriate term. The water level in the lakes is continually fluctuating so that frequently the lakes become entirely dry, as in the case of Fossil Lake in recent years. During Pleistocene time, according to Russell (1884), the water reached a depth of over one hundred feet, so that the three lakes were joined into one large body of water which remained without an outlet. During this expansion of the lake, extensive deposits of sand and clay were formed on the bottom. These deposits have preserved for us the remains of some of the mammals which lived on the borders of the lake at that time, as well as those of fish and birds. The bones have been exposed by the desiccation of the lake and have been intermittently covered by the drifting sand which at present obscures a large part of the ancient lake bottom.

REVIEW OF PREVIOUS INVESTIGATIONS

Although the presence of bones at Fossil Lake had been apparent to the cattlemen of the region for some time, they were first brought to the attention of men with scientific training by Governor Whiteaker, who had noticed them while on a campaigning tour of southeastern Oregon in 1876. He called the attention of Professor Thomas Condon to them, with the result that in 1877 Condon visited Fossil Lake under the guidance of Governor Whiteaker's son. Later in the same year, extensive collecting was done by Charles H. Sternberg, the specimens being sent to Professor E. D. Cope. Two years later, in 1879, Cope visited the locality in person. Apparently no further collections were made at Fossil Lake until Miss Annie M. Alexander visited the region in 1901; the specimens procured at that time are now in the Museum of Palæontology of the University of California. To those specimens have been added further collections made by Chester Stock and E. L. Furlong in the summers of 1923 and 1924.

The early explorations resulted in a number of short articles from the pen of Professor Cope, describing the situation of the deposit and publishing his identifications of the forms discovered. No detailed descriptions of the mammals were published, with the exception of *Auchenia vitakeriana* (1878*a*), *Mylodon sodalis* (1878*a*), *Eschatius conidens* (1884*b*) and *Eschatius longirostris* (1884*b*). Cope described some species of birds (1878*a*) and of fishes (1878*a*, 1878*c*, 1883*b*). Much attention was paid at the time to the association of Indian arrow heads with the fossils, although it was recognized that this association might well be fortuitous. Cope's latest revision of the fauna is found in an article in the *American Naturalist* (1889*b*). In 1902, Dr. W. D. Matthew revised the mammals in Cope's collection.

In 1892, Shufeldt (1891, 1892) published his first detailed description of the avifauna, based on Cope's collection and the collection of Professor Condon. D. S. Jordan (1907) described some of the fossil fish. In 1911, L. H. Miller added some new names to the list of fossil birds, and it was further increased by a second study on the part of Shufeldt (1913). In the plates accompanying his paper, Shufeldt illustrated some mammalian material which had been inadvertently included in the avian material sent to him for examination. The mammalian remains were identified by J. W. Gidley.

AGE OF THE FOSSIL LAKE FAUNA

The age of the Fossil Lake deposit has been discussed at length by several authors, but this discussion has resulted in no definite conclusion. Cope (1889*a*) believed that the palæontologic evidence confirmed its age as Upper Pliocene, as suggested by Clarence King. As the result of a reconnaissance of the region, Russell (1884) recognized the similarity of the geologic phenomena indicated at Fossil Lake to those of Lake Lahontan. This apparent disagreement with the Upper Pliocene age advocated by Cope was thoroughly discussed by G. K. Gilbert (1890). Gilbert came to the conclusion that on geologic evidence the Fossil Lake beds belong to the epoch of the Upper Lahontan beds or Later Pleistocene, but that the palæontologic evidence indicated a closer affinity with the Upper Pliocene or Lower Pleistocene. W. D. Matthew (1902) recognized the similarity of the fauna to that found at Hay Springs, Nebraska. In 1904, W. J. Sinclair concluded that it was probably of about the same age as the fauna of the Potter Creek Cave. Osborn (1909) referred the fauna to the "Subsequent Phases of the Middle Pleistocene," but in 1910 he placed it in the "Early phases of the Equus Zone" or early Pleistocene. O. P. Hay (1912, 1923, 1927) agreed with the determination of the age as early Pleistocene, considering it as belonging to the Aftonian interglacial stage. In 1918, J. C. Merriam gave a comprehensive review of the problem in connection with the age of a fauna found in the deposits of Lake Lahontan, concluding that, since approximately two-thirds of the mammals belong to extinct species, the age of the fauna must be quite far removed from the present. Miller (1925) concluded that Fossil Lake is of greater age than either McKittrick or Rancho La Brea, having 37% of extinct species of birds, compared with 27% for Rancho La Brea and 20% for McKittrick.

The present study has confirmed the early Pleistocene age of the Fossil Lake deposits. The mammalian fauna is found to embrace 17 genera including 23 species, of which 8 genera, or 47%, and 15 species, or 65%, are now extinct. In arriving at the figures for the species, there was some room for error on account of the fragmentary nature of the material, but it is not believed that the deviation is very great. This would place the age of the Fossil Lake fauna close to that of Rancho La Brea, with 67% of extinct mammalian species, Hawver Cave with from 50–75%, McKittrick with almost all extinct, Hay Springs with 67% and Port Kennedy with 74%, the figures being computed from data in

Hay.[1] It is the belief of Hay that all these faunas belong to some portion of the Aftonian interglacial stage.

When it comes to a closer comparison of the relative age of the western Pleistocene deposits, more uncertainty is encountered. Comparing Fossil Lake with Rancho La Brea, the most noticeable differences are the absence in the Fossil Lake fauna of *Bison, Mastodon, Megalonyx, Smilodon* and *Capromeryx*. But negative evidence is of dubious value with as scanty material as that of Fossil Lake; until the present study was undertaken, the absence of *Arctotherium, Canis dirus* and felids of any description was urged as evidence of a difference in age between Fossil Lake and Rancho La Brea. The most accurate estimate of the age of the Fossil Lake fauna which we are justified in making on the basis of the mammalian remains is early Pleistocene, approximating that of Rancho La Brea.

MAMMALIAN FAUNA

The fossils collected from the Fossil Lake beds are now distributed in three places. The largest collection, made by Sternberg and Cope, is the property of The American Museum of Natural History. The specimens collected by Condon are in the possession of the University of Oregon. The remainder of the known specimens from Fossil Lake are in the Museum of Palæontology of the University of California. They were collected in part by Miss Alexander in 1901 and in part by Stock and Furlong in the summers of 1923 and 1924.

The present paper is based on the material in the University of California and American Museum collections. It was not possible to study the collections at the University of Oregon. A complete list of the material there has never been published, but partial lists prepared by Ellen Condon McCornack (1914 and 1920) contain no mention of forms not represented in the collections studied.

In the following list of the mammalian fauna of Fossil Lake, † indicates that the species is extinct and †† that the genus also did not survive the Pleistocene in North America.

CARNIVORA
- †*Canis* cf. *dirus*
- *Canis* cf. *occidentalis*
- *Canis lestes.*
- *Vulpes* sp.

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[1] Hay, O. P. 'Pleistocene of North America.' Carnegie Institution of Washington, Publs. 322, 322A, 322B. 1923, 1924, 1927.

- ?†*Felis* sp. major
- *Felis* sp. minor
- ††*Arctotherium* sp.
- ?†*Taxidea*, probably n. sp.

RODENTIA

- †*Castor*, probably n. sp.
- †*Fiber oregonus*
- *Microtus montanus*
- *Thomomys townsendi*

LAGOMORPHA

- *Lepus* sp.

EDENTATA

- ††*Mylodon*, near *harlani*

PROBOSCIDEA

- ††*Elephas ?columbi*

PERISSODACTYLA

- ††*Equus pacificus*
- ††*Equus* sp. minor.

ARTIODACTYLA

- *Antilocapra* cf. *americana*
- ††*Platygonus* cf. *vetus*
- ††*Platygonus* sp. minor
- ††*Camelops hesternus*
- ††?*Tanupolama* sp.
- ††*Eschatius* sp.

DESCRIPTION OF MATERIAL

CARNIVORA

Canidæ

Canis cf. dirus

The presence of the dire-wolf in the Fossil Lake beds is apparently indicated by a fragmentary lower carnassial of the right side, U. C. 26910. Only the heel and portions of the protoconid and metaconid are preserved. The features which distinguish this tooth from the lower carnassials of the timber-wolves and which suggest affinity with *C. dirus* are its size and the character of the heel. The greatest width of the heel is 13.4 mm., almost equaling that of larger individuals of *C. dirus* from Rancho La Brea. Of eleven specimens of wolves of various species in the collections of the California Museum of Vertebrate Zoology, the largest M_1, that of *C. occidentalis,* has a heel measuring 11.4 mm. in greatest width. Merriam[1] gives the greatest transverse diameter of the heel of M_1 of a specimen of *C. occidentalis* from Canada as 12.2 mm.

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[1] Merriam, J. C. 1912. 'The Fauna of Rancho La Brea.' Univ. Calif. Mem., I, No. 2, p. 232.

The heel of the tooth from Fossil Lake is therefore at least one millimeter wider than that of the large timber-wolves now living in North America.

The heel is characterized by a well developed hypoconid and a smaller entoconid, the latter cusp being joined to the hypoconid by a sharp ridge. Another ridge joins the hypoconid and protoconid. A third ridge, connecting the entoconid and metaconid, bears three small tubercles, similar in appearance and position to those found in M_1 of *C. dirus*. Tubercles resembling these are sometimes found in modern timber-wolves but they are never as well developed. The three ridges enclose a basin of pronounced depth. This basin is never so well developed in the modern wolves as in those of the *C. dirus* group, due to the less perfect development of the connecting ridges in the modern forms.

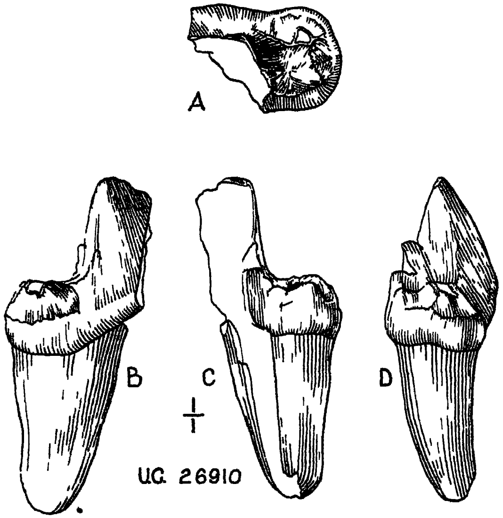


Fig. 1. *Canis* cf. *dirus*. Right lower M_1. Univ. Calif. 26910.
A, Crown view. B, external view. C, internal view. D, Posterior view. Natural size.

The hypoconid of the Fossil Lake tooth differs from that in the typical representatives of *C. dirus* and *C. milleri* in occupying a median position on the heel instead of being nearer the buccal border. The importance of this character is doubtful in view of the great variation which it undergoes.

The limb elements referred to *C. dirus* include the distal two-thirds of a humerus and right metacarpals 3 and 5. These agree with the corresponding elements of *C. dirus* in length but are slightly more slender.

Canis cf. **occidentalis**

Occurring in conjunction with the remains of *Canis* cf. *dirus* are those of another large wolf. This form resembles *C. occidentalis,* but, since it is known only by a radius, humerus, navicular and calcaneum and a few other fragments, precise identification is impossible. This form approaches *C. occidentalis* quite closely in size, the elements being about one-twentieth longer and slightly heavier. In view of this close similarity, it seems advisable to refer this form provisionally to *C. occidentalis,* recognizing the possibility that future collections may show that it grades into the larger form, *C.* cf. *dirus.*

Canis lestes

The most abundant canid remains are those of the coyote, consisting of five fragmentary mandibles and nine metapodials. The mandible differs from that of *C. latrans* in having a more vertical coronoid process and from both *C. latrans* and *C. estor* in having a more convex inferior border. In both these characters it resembles *C. lestes.*

Vulpes sp.

A femur and a tibia, both of the right side, are the only known remains of the foxes of Fossil Lake. In general proportions the two bones resemble *Vulpes* more closely than they do *Urocyon* and are therefore referred to *Vulpes.*

Felidæ

Felis sp. major

Of the two types of cats found at Fossil Lake, the larger is represented by portions of an ulna, a radius and a tibia, a scapholunar, a metacarpal, a metatarsal and a thoracic vertebra. In size the elements are intermediate between the puma, *Felis oregonensis californica,* and the fossil lion, *Felis atrox.* The scapholunar apparently belonged to a larger individual than did the other bones. Due to the fragmentary condition of the material, it is impossible to conclude whether this large feline of Fossil Lake constitutes a new species or should be referred to *Felis atrox.*

Felis sp. minor

The smaller member of the Felidæ is known by very fragmentary remains of a humerus, ulna, radius and three metapodials. In size it is intermediate between the ocelot, *Felis pardalis*, and the cougar, *Felis concolor*.

Ursidæ

Arctotherium sp.

The Ursidæ are represented by three bones: an ectocuneiform, a worn metapodial and a proximal phalanx. The ectocuneiform was compared with corresponding bones of *Arctotherium simum* from Potter Creek Cave, an arctothere from the Rock Creek Pleistocene, *Euarctos americanus*, and two large Alaskan bears, *Ursus gyas* and *Ursus alexandræ*. The Fossil Lake specimen, U. C. 26915, bears a very close resemblance to U. C. 8343 from Potter Creek Cave, differing from it in being slightly larger and in having the anterior facet for metatarsal II slightly concave instead of convex. It agrees in shape with the Rock Creek specimen, A. M. N. H. 12392, but exceeds it in size. The ectocuneiform of the black bear, *Euarctos americanus*, is remarkably close in shape to that of *Arctotherium simum*, but in even the largest individuals of *Euarctos*, as well as of *Ursus*, the ectocuneiform is persistently of a much smaller size than in the Fossil Lake or Potter Creek Cave specimens.

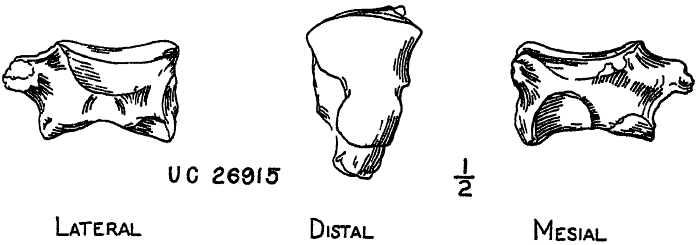


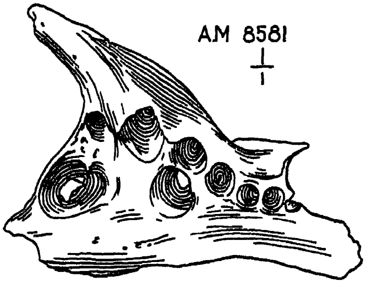
Fig 2. *Arctotherium* sp. Right cuneiform, Univ. Calif. 26915. One-half natural size.

Mustelidæ

Taxidea, probably n. sp.

The presence of the badger in the Fossil Lake fauna has not been previously reported. It is represented by a right maxilla containing a well-worn M^1 and by fragmentary limb bones. The maxillary bone conforms in size to *Taxidea americana* but differs in that M^1 is wider, being 13.8 mm. wide in the fossil and having a maximum of 11.4 in the specimens of *T. americana* studied. The limb bones are fragmentary but indicate an animal about one-sixth larger than the modern species.

The inclusion of *Lutra* in Matthew's faunal list was due to an erroneous identification of the maxillary bone shown by the present study to belong to a badger. There is no evidence of the presence of *Lutra* in the Fossil Lake beds.



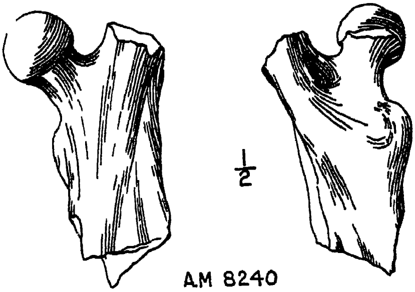


Fig. 3. *Taxidea*, probably n. sp. Right maxilla. Amer. Mus. 8581. Natural size.

Fig. 4. *Castor*, probably n. sp. Left femur. Amer. Mus. 8240. One-half natural size.

RODENTIA

Castoridæ

Castor, probably n. sp.

Three elements, a tooth, parts of an ilium and the proximal portion of a femur, belong to the genus *Castor*. The tooth is a M^1 or M^2 of the right side and cannot be distinguished from similar teeth of *C. canadensis*. The ilium is likewise indistinguishable from the same bone of the larger beavers of to-day. The femur differs from that of *C. canadensis* in being slightly larger and heavier and in that the notch between the head of the femur and the great trochanter is deeper. Although the shape of the notch varies greatly in the modern beaver, no specimen was observed which approximated the condition in the fossil. It may be that more complete material would warrant the creation of a new species to embrace the Fossil Lake beaver, but the present material is inadequate.

Cricetidæ

Fiber oregonus Hollister

Fiber oregonus was described and figured by Hollister (1911) from Fossil Lake, the type and only known specimen being the right mandibular ramus of a young adult, A. M. N. H. 8594. Hollister states that the mandible is almost identical with the corresponding bone of the living species except that it is much smaller; the "anterior loop of M_1 with deeper reentrant angles than in any living species; triangles not completely closed in any case."

Muridæ

Microtus montanus (Peale)

The meadow mouse is represented in the American Museum collections by the major portion of the horizontal ramus of a right mandible, including M_1 and M_2. *Microtus* sp. has also been reported by Miss McCornack in the University of Oregon collection.

Geomyidæ

Thomomys townsendi (Bachman)

The *Thomomys* remains from Fossil Lake have been referred to in the literature as follows:

Thomomys near *clusius*.	Cope, 1878*a*, 1879, 1884*a*, 1889*a*, 1889*b*.
Thomomys talpoides.	Cope, 1878*a*, 1879, 1884*a*.
Thomomys bulbivorus.	Cope, 1883*a*, 1889*a*, 1889*b*.
Thomomys sp.	Matthew, 1902.
Thomomys scudderi, n.sp.	Hay, 1921.

As this list testifies, considerable confusion has prevailed as to the specific determination of the pocket gopher from Fossil Lake, this confusion reaching its climax in the creation of the new species *T. scudderi* by Hay in 1921, the type specimen being A. M. N. H. 8596. A detailed study of the skulls in the University of California collection, which had not been previously compared, supplemented by the material in the American Museum, has resulted in the inclusion of the fossil form in the still existent species *T. townsendi* (Bachman). Of this species, Bailey[1] recognizes two living subspecies: *T. townsendi townsendi*, now inhabiting the southern portion of Idaho, and *T. townsendi nevadensis*, found at present in north-central Nevada and the southeastern corner of Oregon.

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[1] Bailey, Vernon. 1915. 'Revision of the Pocket Gophers of the Genus *Thomomys*.' North American Fauna No. 39.

The form found in the Fossil Lake beds does not seem to be subspecifically identical with either *T. t. townsendi* or *T. t. nevadensis.* The cheek tooth series is somewhat shorter and the individual teeth are slightly narrower than in *townsendi* or *nevadensis.* The posterior margin of the premaxilla is sharply pointed, in this respect resembling *townsendi;* a few of the specimens of *nevadensis* which were examined have tapering premaxillæ, but they are rounded at the extreme posterior tip. This character is subject to some variation. In the Fossil Lake specimens, the premaxillæ bear an outwardly projecting horizontal shelf which is very similar to that in *nevadensis.* In the single specimens of *townsendi* available for examination, a female, this shelf is not well developed. Examination of a series of *nevadensis* specimens indicates that this character is variable, the shelf not being so well developed in the female. The importance of this character, therefore, can not be judged before examining a larger series of skulls of *townsendi.* A fragment of the posterior portion of the skull, including the interparietal, has two temporal ridges, similar to the condition in both living subspecies.

The fossil form differs from *T. bulbivorus* in the following characters: smaller size; frontal process of premaxilla more sharply pointed and maxillary process of frontal more obtuse; lateral suture of maxilla with frontal straight or slightly convex instead of straight or slightly concave; temporal ridges not so well developed as the sagittal crest of *bulbivorus.*

From *T. talpoides clusius* the fossil specimens are separable on the basis of: larger size; more sharply pointed premaxillæ; less curvature of upper incisors; deeper rostrum; greater ventral extension of the zygomatic process of the maxilla; greater height of the depression in front of the infraorbital foramen.

The pocket gopher now living in the region of Fossil Lake is *T. quadratus quadratus.* The fossil form differs from *T. q. quadratus* in: larger size; nasals pointed posteriorly instead of truncate; premaxillæ extending farther posteriorly with reference to the nasals and being sharply pointed instead of rounded or truncate at their posterior termination; rostrum relatively wider; depression in front of infraorbital foramen has a longer dorso-ventral extension.

LAGOMORPHA

Leporidæ

Lepus sp.

That jackrabbits were relatively abundant at Fossil Lake seems a reasonable inference from the number of skeletal fragments found. The remains, however, are confined largely to the calcaneum, portions of the pelvis and limb bones. From these it is impossible to tell whether the fossil form was closely related to *L. townsendi* (formerly *L. campestris*), to which it has been referred, or to *L. californicus*, also found in eastern Oregon today, or whether it might not be a separate species.

EDENTATA

Mylodontidæ

Mylodon near **harlani** Owen

The ground sloth was described as a new species, *Mylodon sodalis*, by Cope (1878*a*, p. 385) from a collection containing "a number of phalanges, including those of the ungues." The new species was based on an ungual phalanx (Cope, 1889*c*, p. 661, Fig. 1) which had the basal sheath developed only on one side and which was more compressed than in *Mylodon harlani*. Later work, as summarized by Stock (1925, p. 195), has shown that the apparent lack of a basal sheath on one side of the phalanx is due to breakage and that there is not sufficient reason for excluding this form from the species *harlani*. On the basis of some material collected by I. C. Russell near Button Ranch in1882, now in the United States National Museum, and a few bones from Fossil Lake, now in the University of California collections, Stock concluded that the mylodont sloths of south-central Oregon are not specifically different from those of Rancho La Brea but that further study might lead to their subspecific distinction: he suggested that the name *sodalis* might be retained as the subspecific designation.

Further study of the foot elements shows that they agree in general with those of *Mylodon harlani* from Rancho La Brea except that they are invariably of a slightly larger size. Some differences have been noted between the Fossil Lake form and that from Rancho La Brea, but their significance cannot be evaluated with the limited material at hand.

PROBOSCIDEA

Elephantidæ

Elephas ?columbi

The proboscidean remains from Fossil Lake include fragmentary limb and vertebral material and teeth. These were originally determined as *Elephas primigenius* by Cope, but Matthew (1902) referred them questionably to *Elephas columbi*. There is in addition a fragmentary lower right molar, A. M. N. H. 8629, of which only the six last plates are preserved. It has been referred to *Elephas imperator*, but there seems to be no valid reason why it could not belong to the same species as the other remains.

PERISSODACTYLA

Equidæ

Equus pacificus

Equus sp. minor

The horses of Fossil Lake have been studied by Stock and Furlong; the detailed results of their work will appear elsewhere. They concluded[1] that two types of horses are present, *Equus pacificus* and a new species of relatively small size.

ARTIODACTYLA

Antilocapridæ

Antilocapra cf. **americana**

The antelope remains, consisting of three astragali, the distal end of a humerus, proximal portion of an ulna, the acetabular region of a pelvis, and one tooth, either I_3 or C_1, are indistinguishable from the corresponding skeletal elements of *Antilocapra americana.*

Tagassuidæ

Platygonus cf. **vetus**

Platygonus sp. minor

Matthew (1902) reported some peccary teeth in the American Museum collection. He recognized two species, *Platygonus* cf. *vetus* and *Platygonus* sp. minor. Unfortunately this material was not available for the present study, so it is impossible to confirm the identification.

Camelidæ

Camelops hesternus Leidy

The largest camel present at Fossil Lake is represented by a fragment of the left maxillary containing part of M^1, a portion of the right mandible from the symphysis through M_1, and a number of limb bones and vertebræ. These agree in their diagnostic features and size with the corresponding elements in *Camelops hesternus* from Rancho La Brea. In the study of the limb elements it was not always possible to differentiate with certainty between those belonging to *C. hesternus* and those of *Eschatius conidens,* although the latter is somewhat smaller, approaching the size of the dromedary.

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[1] Oral communication from Professor Stock.

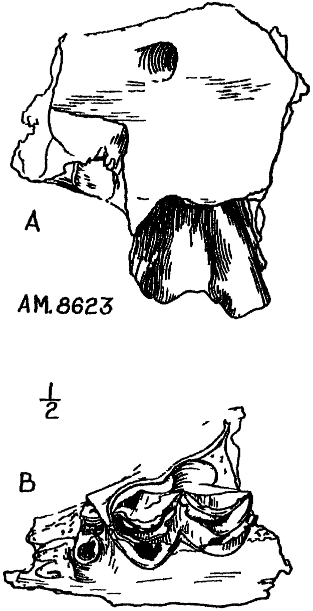

Fig 5.

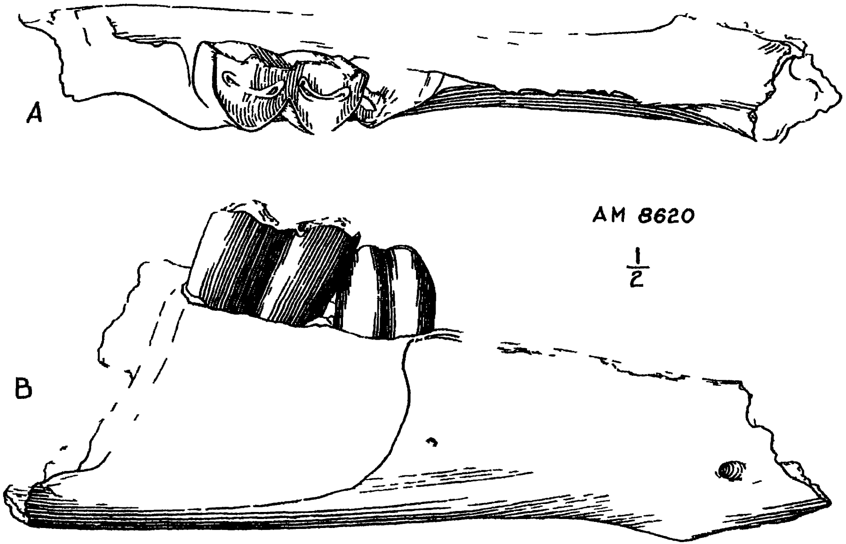

Fig 6.

Fig. 5. *Camelops hesternus.* Part of left maxilla. Amer. Mus. 8623. A, lateral view. B, crown view. One-half natural size.

Fig. 6. *Camelops hesternus.* Portion of right mandible. Amer Mus. 8620. A, crown view. B, lateral view. One-half natural size.

Although numerous proximal phalanges of camels are preserved in the American Museum and University of California collections from Fossil Lake, none of them resembles the phalanx from Washtuckna Lake, Washington, described by Hay (1921, p. 600–1) as the type of a new species, *Camelus maximus*. To this species Hay referred some limb elements from Fossil Lake, largely on the basis of size. There seems to be no valid reason for excluding those limb elements from *Camelops hesternus*.

?**Tanupolama** sp.

The specimen here referred to *Tanupolama* is a portion of the left maxillary, A. M. N. H. 8624. It was described as *Auchenia vitakeriana* by Cope in 1878. Later Cope became convinced that it possessed only one superior premolar rather than two, necessitating its inclusion in the genus *Holomeniscus*. Wortman (1898) concluded that there were two premolars and included the form in the genus *Camelops*.

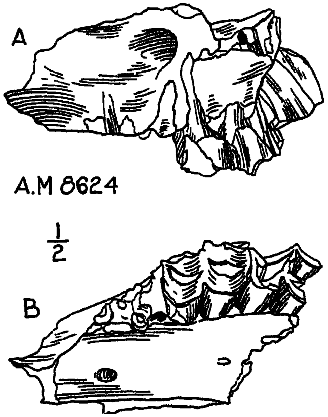

Fig. 7. ?*Tanupolama* sp. Left maxilla. Amer. Mus. 8624. A, lateral view. B, crown view. One-half natural size.

The specimen consists of the major portion of a left maxillary bone containing M^1 and part of M^2. The fourth upper premolar is represented by three strong roots, one postero-internal and two external. The position of the roots suggests that P^4 was a triangular tooth with an anteroposterior diameter about two-thirds that of M^1. The possibility that the tooth belonged to the milk dentition was considered, but excavation of the jaw revealed no permanent tooth in position to replace it. A small, irregular pit in front of the antero-external root of P^4 indicates that the animal may have possessed a vestigial P^3. A larger pit in front of the internal root of P^4 has no significance with regard to the teeth; similar pits are found in modern camels.

The three genera of fossil camels with which this specimen might claim kinship are *Eschatius, Camelops* and *Tanupolama.* It is excluded from *Eschatius* because P^4 is much better developed than in that genus. Compared with *Camelops hesternus* from Rancho La Brea, the Fossil Lake form shows a distinct similarity in the shape of M^1. The fourth premolars cannot be compared accurately, since the roots alone are left. P^3, if present, was very greatly reduced compared with *C. hesternus.* The position of the infraorbital foramen above the boundary between P^4 and M^1 is similar to that in *Camelops,* but its shape, with the lateral border inclined downward and forward instead of downward and backward, is more like that in the recent *Lama* and in *Tanupolama.* The general size of the Fossil Lake specimen is smaller than that of *Camelops.*

The discovery of well preserved skull and skeletal material of a medium-sized camel at McKittrick prompted Stock[1] to erect a new genus, *Tanupolama.* There is a startling similarity between the specimen here under consideration and the figured specimens of *Tanupolama stevensi.* No significant differences in the maxillary bone or dentition are to be found. The Fossil Lake specimen agrees very closely in size with the known specimens of *Tanupolama.* It is, therefore, tentatively referred to that genus. With the present fragmentary material, it is futile to attempt a specific determination.

Eschatius sp.

Eschatius conidens was described by Cope (1884*b*, pp. 19–20), using as the type a maxillary bone containing all its teeth, preserved in the Museum of the School of Mines of Mexico and coming originally from Tequixquiac. At the same time Cope described some remains from Fossil Lake, consisting of a fragmentary left maxillary lacking all the teeth and with the lateral wall of the alveoli missing, a fragment of the mandible containing P_4 and isolated pieces of the skull, which he referred to the same genus and species.

The character which separates the genus *Eschatius* from the other genera of Pleistocene camels is the reduction of P^4 to a simple cone. In the Fossil Lake specimen all that remains of P^4 is one alveolus, that

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[1] Stock, Chester 1928. 'Tanupolama, a New Genus of Llama from the Pleistocene of California.' Carnegie Instn. of Wash., Publ. 393, pp. 31–38

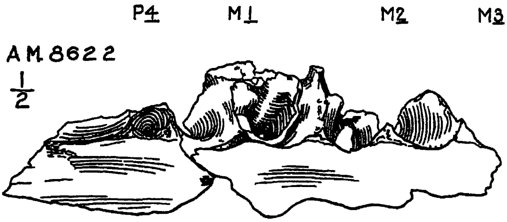

Fig 8. *Eschatius* sp. Left maxilla. Amer. Mus. 8622. Crown view. One-half natural size.

for the postero-internal root. The maxillary border is preserved anterior to this alveolus, precluding the possibility that any antero-external root was present. There is no way of ascertaining whether there was a postero-external root. The reduction of P^4 seems, therefore, to be indicated clearly enough to warrant the inclusion of the specimen in the genus *Eschatius;* but it would be presumptuous to attempt to establish its specific identity with the Mexican form.

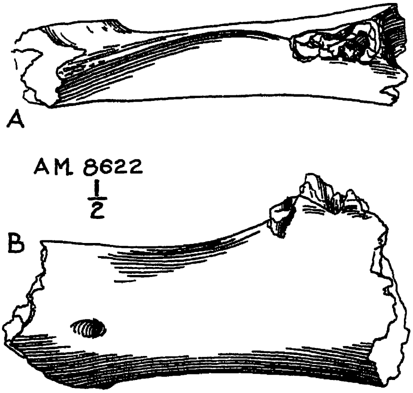

Fig. 9. *Eschatius* sp. Left mandible. Amer. Mus 8622. A, crown view. B, lateral view. One-half natural size.

A mandibular fragment, A. M. N. H. 8622, the anterior part of the left ramus, including P_4 and half the symphysis, was also referred by Cope to *E. conidens.* Its chief characteristics are the absence of P_1 and the antero-posterior elongation of P_4, which has two well developed roots.

At the same time that he described *E. conidens,* Cope also erected another species of *Eschatius, E. longirostris,* the type and only known

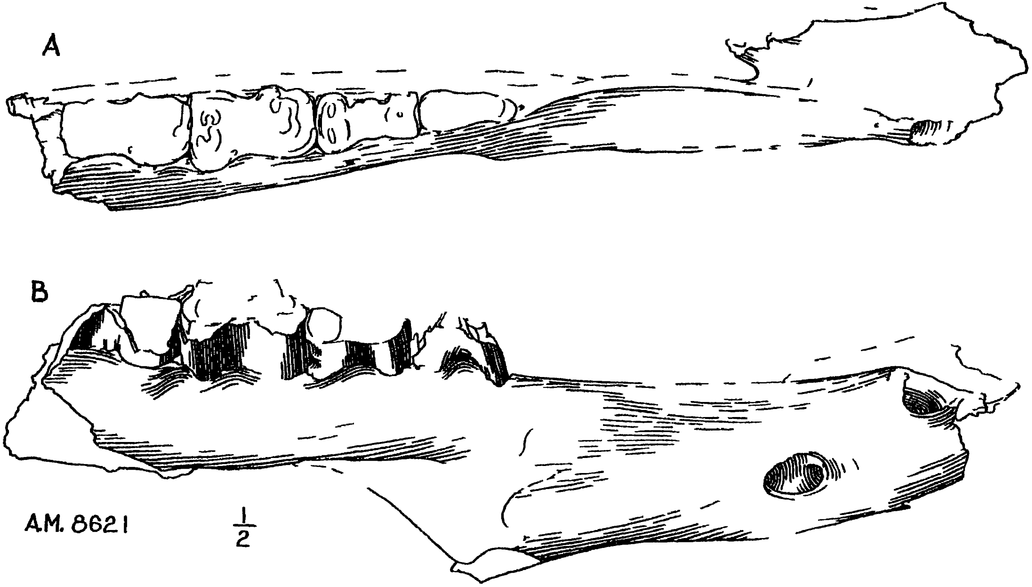

Fig 10 *Eschatius* sp Right mandible Amer Mus 8621 A, crown view B, lateral view One-half natural size

specimen (A. M. N. H. 8621) being the right ramus of a mandible containing exceedingly deeply worn P_4, M_1 and $_2$ and part of M_3. It differs from the mandible described above by having a longer diastema; this is, however, correlated with a generally larger size and might be due to advanced age. The symphysis of this mandible is co-ossified, while that of the specimen referred to *E. conidens* by Cope is not. Comparison of the size of the teeth with that of the upper teeth, indicated by the alveoli, in the maxillary considered above, leads to the conclusion that the mandible constituting the type of *E. longirostris* belongs to the same species as the other *Eschatius* material of Fossil Lake. The fragmentary mandible originally referred to *E. conidens* by Cope very likely appertained to a smaller or younger individual.

The limb elements of *E. conidens* are not clearly separable from those of *Camelops hesternus*, differing chiefly in being slightly smaller.

BIBLIOGRAPHY OF THE LITERATURE CONCERNING FOSSIL LAKE

ANONYMOUS. 1877. 'The wonderful fossil beds of Oregon.' West. Rev. Sci., I, pp. 608–610.

CONDON, THOS. 1902. 'The two islands.' Portland, Oreg.

1910. 'Oregon Geology.' Portland, Oreg.

COPE, E. D. 1878*a*. 'Description of new extinct Vertebrata from the Upper Tertiary and Dakota formations.' Bull. U. S. Geol. and Geog. Surv. Terr., IV, pp. 379–396.

1878*b*. 'Pliocene man.' Amer. Nat., XII, pp. 125–126.

1878*c*. 'Descriptions of new Vertebrata from the Upper Tertiary formations of the West.' Proc. Amer. Philos. Soc., XVII, pp. 219–231. Issued also as part of Pal. Bull. No. 28.

1879. 'Relations of the horizons of extinct Vertebrata of Europe and North America.' Bull. U. S. Geol. and Geog. Surv. Terr., V, pp. 33–54.

1882. 'The Tertiary formations of the central region of the United States.' Amer. Nat., XVI, pp. 13–195.

1883*a*. 'The extinct Rodentia of North America.' Amer. Nat., XVII, pp. 373–374.

1883*b*. 'On the fishes of the Recent and Pliocene lakes of the western part of the Great Basin, and of the Idaho Pliocene lake.' Proc. Acad. Nat. Sci. Phil., pp. 134–166.

1884*a*. 'Vertebrata of the Tertiary formations of the West.' Rept. U. S. Geol. and Geog. Surv. Terr., III, pp. 40–41.

1884*b*. 'The extinct Mammalia of the Valley of Mexico.' Proc. Amer. Philos. Soc., XXII, pp. 1–21. Also as part of Pal. Bull. No. 39.

1886. 'Phylogeny of the Camelidæ.' Amer. Nat., XX, p. 611.

1889*a*. 'Vertebrate fauna of the Equus beds.' Amer. Nat., XXIII, pp. 160–165.

1889*b*. 'Silver Lake of Oregon and its region.' Amer. Nat., XXIII, pp. 970–982.

1889*c*. 'The Edentata of North America.' Amer. Nat., XXIII, pp. 657–64.

GILBERT, G. K. 1890. 'Lake Bonneville.' U. S. Geol. Surv., Mon. I, pp. 303–305, 393–402.

HAY, OLIVER P. 1912. 'The recognition of Pleistocene faunas.' Smithson. Misc. Coll., LIX, No. 20, 16 pp.

1921. 'Descriptions of species of Pleistocene Vertebrata.' Proc. U. S. Nat. Mus., LIX, pp. 599–642.

1923. 'The Pleistocene of North America and its vertebrated animals from the states east of the Mississippi River and from the Canadian provinces east of longitude 95°.' Carnegie Instn. Wash., Publ. 322, pp. 1, 10–11.

1927. 'Pleistocene of the western region of North America and its Vertebrated Animals.' Carnegie Instn. Wash., Publ. 322B.

HOLLISTER, NED. 1911. 'A systematic synopsis of the muskrats.' North American Fauna, No. 32, p. 33.

JORDAN, D. S. 1907. 'Fossil fishes of California.' Univ. Calif. Publ., Bull. Dept. Geol., V, pp. 95–144.

McCORNACK, ELLEN C. 1914. 'A Study of Oregon Pleistocene.' Univ. Oregon Bull., N.S. XII, No. 2, pp. 1–16.

1920. 'Contributions to the Pleistocene history of Oregon.' Univ. Oregon, Leaflet Ser., Geol. Bull., VI, No. 3, Pt. 2, pp. 3–23.

MATTHEW, W. D. 1902. 'List of the Pleistocene Fauna from Hay Springs.' Bull. Amer. Mus. Nat. Hist., XVI, pp. 317–322.

MERRIAM, J. C. 1918*a*. 'Evidence of mammalian palæontology relating to the age of Lake Lahontan.' Univ. Calif. Publ. Bull. Dept. Geol., X, pp. 517–521.

1918*b*. 'Note on the systematic position of the wolves of the Canis dirus group.' Univ. Calif. Publ., Bull. Dept. Geol., X, pp. 531–533.

MILLER. LOYE H. 1911. 'Additions to the avifauna of the Pleistocene deposits at Fossil Lake, Oregon.' Univ. Calif. Publ., Bull. Dept. Geol., VI, pp. 79–87.

1912. 'Contributions to avian palæontology from the Pacific Coast of North America.' Univ. Calif. Publ., Bull. Dept. Geol., VII, pp. 61–115.

1925. 'Avifauna of the McKittrick Pleistocene.' Univ. Calif. Publ., Geol. Sci., XV, pp. 307–326.

OSBORN, H. F. 1909. 'Cenozoic mammal horizons of Western North America.' U. S. Geol. Surv., Bull. 361.

1910. 'Age of mammals.' New York, Macmillan, pp. 458–461.

RUSSELL, I. C. 1884. 'A geological reconnaissance in southern Oregon.' U. S. Geol. Surv., 4th Ann. Rept., pp. 431–464.

SHUFELDT, R. W. 1891. 'On a collection of fossil birds from the Equus beds of Oregon.' Amer. Nat., XXV, pp. 359-362.

1882. 'A study of the fossil avifauna of the Equus beds of the Oregon desert.' Jour. Acad. Nat. Sci. Phila., IX, pp. 389-425.

1912. 'New and extinct birds from the Pleistocene of Oregon.' Science, N.S., XXXVII, pp. 306-307.

1913. 'Review of the fossil fauna of the desert region of Oregon with a description of additional material collected there.' Bull. Amer. Mus. Nat. Hist., XXXII, pp. 123-178. 35 plates.

SINCLAIR, W. J. 1904. 'The exploration of the Potter Creek Cave.' Univ. Calif. Publ., Amer. Arch. and Eth., II, pp. 1-27.

STERNBERG, C. H. 1881. 'The Pliocene beds of southern Oregon.' Kansas City Rev. Sci., Indust., IV, pp. 601-602.

1884. 'The fossil fields of southern Oregon.' Kansas City Rev. Sci. Indust., VII, pp. 596-599.

1909. 'The life of a fossil hunter.' New York, Henry Holt & Co., pp. 144-169.

STOCK, CHESTER. 1925. 'Cenozoic gravigrade edentates of western North America.' Carnegie Instn. Wash., Publ. 331, pp. 194-197.

WARING, G. A. 1908. 'Geology and water resources of a portion of south-central Oregon.' U. S. Geol. Surv., Water Supply Paper 220.

WORTMAN, J. L. 1898. 'The extinct Camelidæ of North America, and some associated forms.' Bull. Amer. Mus. Nat. Hist., X, pp. 93-142.

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NEW SPECIES OF POLYCHÆTOUS ANNELIDS FROM CALIFORNIA, MEXICO, PORTO RICO, AND JAMAICA

By A. L. Treadwell

Lumbrinereis singularisetis, new species

Figures 1 to 3

The total body length is 105 mm. and its greatest width not quite 3 mm. The prostomium is nearly 2 mm. long and a little more than 1 mm. wide.

The prostomium (Fig. 1) resembles a sugar-loaf in outline and has a slightly narrowed base. A shallow groove runs longitudinally along its dorsal surface. The two nuchal organs show as a dark-colored area on either side. Somite 1 is about one-third as long as the prostomium, somite 2 is a little longer than 1, somite 3 about as long as 1. Later ones increase very slightly in length and more considerably in width until the full size is reached. The parapodia begin on somite 3 as very small elevations which first reach their characteristic form on somite 7. They are never very prominent. The posterior lobe extends beyond the setal portion to a distance about equal to the height of the latter. In the dorsal part of the setal bundle are a few setæ like figure 2, which have long stalks bending sharply toward the end to terminate in an acute point. Each has two finlike expansions lying at about an angle of 45° to one another, which in full face show as two, but from a side view only one can be seen. Toward the ventral part of the parapodium are similar but smaller setæ. Between these two sets are a few shorter ones having a heavy central stalk and marginal wings; their end is bluntly rounded (Fig. 3). These differ from the usual form of this type of setæ in *Lumbrinereis* in that there are no distinct teeth at the end of the shaft. Owing to an accident, the head was badly broken after most of the above description was written, but before the jaws were described. The most that can be said about them is that they were very dark-colored.

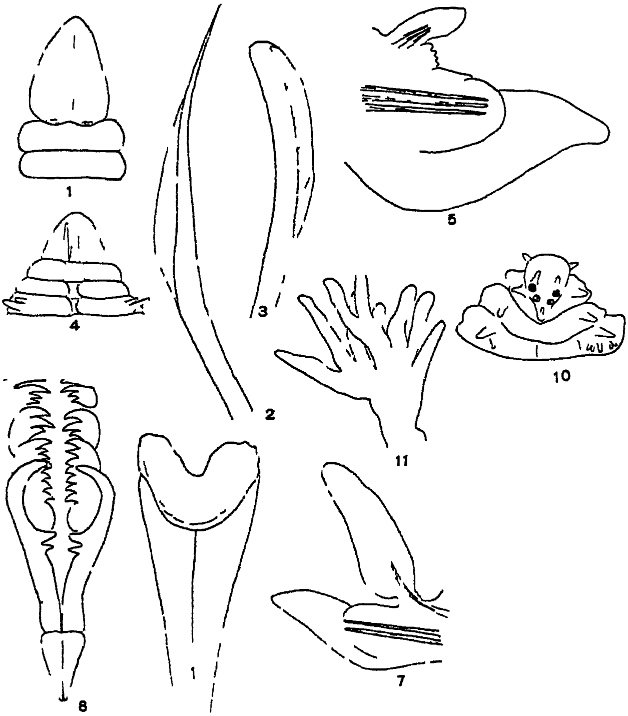
Collected at Monterey, California by E. C. Starks. The type and only specimen is No. 2065 in The American Museum of Natural History.

Oenone brevimaxillata, new species

Figures 4 to 9

An imperfect specimen in which the first fifty somites are well preserved, but the remainder of the body much flattened and very soft. The entire surface is very iridescent, apparently due to the softening which has loosened the surface cuticle. The pygidial region evidently has been regenerating, but little can be said about its structure. The whole is over 400 mm. long and has a width of 6 mm.

The prostomium (Fig. 4) has a width a little greater than its mid-dorsal length. The median tentacle reaches to the anterior prostomial border; the lateral ones are a little shorter than this. On its anterior margin the peristomium is no wider than the prostomium but its posterior margin is wider than it. On its dorsal surface it is noticeably biannulate, but uniannulate ventrally. Over the mid-dorsal surface of the peristomium and the first setigerous somite extends a depression which is wider at its anterior margin and abruptly stops at the anterior margin of the second setigerous somite. This at first was regarded as a wrinkling due to the preservation methods but is obviously normal.



Figs. 1 to 3. *Lumbrinereis singularisetis.* Fig. 1, head × 7.5; Fig. 2, pointed seta × 165; Fig. 3, blunt-pointed seta × 165.

Figs. 4 to 8. *Oenone brevimaxillata.* Fig. 4, head × 3; Fig. 5, eleventh parapodium × 15; Fig 6, unilimbate seta × 52; Fig. 7, posterior parapodium × 10; Fig. 8, maxillæ × 7.5.

Figs. 10 to 12. *Hipponoe elongata.* Fig. 10, head × 10; Fig. 11, gill × 22.5; Fig. 12, seta × 185.

Parapodia begin on somite 2 as very small structures but have the characteristic form, i.e., a heavy postsetal lobe, a much smaller and thinner presetal one, and a small dorsal cirrus. The eleventh parapodium (Fig. 5) is very thick and heavy and has a prominent postsetal lobe which is bent upward. Three very heavy black aciculæ lie in the setal lobe. There is no ventral cirrus. Dorso-laterally and ventro-laterally from the setal lobe arise two tufts of setæ, all unilimbate and sharp-pointed (Fig. 6). Most of them are rather heavy but a few are more slender. The dorsal ones are longer and less numerous than the ventral. In a parapodium from the posterior body region (Fig. 7) the relations of the anterior and posterior lips to the setal portion remain much as before while the dorsal cirrus is much larger, constricted at the base and bent upward. The setæ are more slender and longer than those in anterior somites but otherwise resemble them.

In the maxillæ (Fig. 8) the carrier of the forceps is much shorter than is usual in this genus, the forceps rather straight and bent only near the ends. On the inner margin of each part are two strong teeth, one much larger than the other. The first pair of plates are provided each with seven sharp teeth, the next two with three each, and the final pair have only one. In the second pair of plates the two distal teeth are larger than the proximal, in the third pair the one distal one is larger than either of the two proximal. The mandible (Fig. 9) is the same length as the maxilla and has the usual form. The maxilla is black and there are black pigmented areas laterally on either side not shown in the drawing. The mandible is much lighter in color, the most conspicuous pigmentation being a narrow strip around the margin of the beveled area.

The type and only specimen is from the collection of The American Museum of Natural History and the only locality record is given as "Mexico." It is No. 2082 in the Museum collections.

Nereis largoensis Treadwell

Nereis brevicirrata TREADWELL, 1929, American Museum Novitates, No. 392, pp. 3 to 5, Figs. 9 to 14.

This specific name is proposed to replace *brevicirrata* which was preoccupied. The type is No. 1987, in The American Museum of Natural History.

Hipponoe elongata, new species

Figures 10 to 12

A single specimen, 185 mm. long; greatest body width, including parapodia, 8 mm. The prostomium is about 0.5 mm. wide and 0.8 mm. long (Fig. 10). Its anterior end is rounded; its posterior end terminates in an acute point. The eyes on either side lie behind the midline of the prostomium; those of the same side are set close together, the anterior pair being the larger. In front of either anterior eye is a short blunt tentacle, and another is situated on either side just below the anterior prostomial margin, its tip being visible from above. The unpaired posterior tentacle is represented by a very short elevation near the posterior margin of the prostomium. There is no caruncle.

On either side the first somite extends almost to the anterior border of the prostomium and is interrupted in its mid-dorsal line by the posterior end of the latter. Dorsally each half of this first somite is triangular in outline, its lateral margin forming the base of the triangle. Dorsally the second somite is longest on its lateral margins, and narrows in the mid-dorsal line. Both of the first two somites are without gills but carry prominent dorsal cirri. The third somite is wider than the second and differs from it mainly in the possession of gills on either side posterior to the dorsal cirrus. The dorsal surfaces of all somites are marked with longitudinal lines. Later somites gradually increase in width as far as about the middle of the body. The posterior quarter of the body narrows to the pygidium which is about of the same width as the prostomium. Ventrally the first three somites bound the mouth.

The gills consist of a stout basal portion situated (in preserved material) in a definite depression on whose anterior wall is a cylindrical elevation, truncate at its apex, which carries the dorsal cirrus and the setal tuft, the gills lying, therefore, just posterior to the dorsal cirrus. In the most anterior somites the gills consist of two "hands" of stout branchiæ arising one behind the other on the end of a basal portion. Farther posteriorly the number of these "hands" increases and their arrangement is more complicated. One "hand" is shown in figure 11. Gills occur on all somites from the third to the one just in front of the anal. In general their sizes are correlated with the size of the somite on which they occur, but so far as can be told from preserved material they are never very prominent.

The anal opening is very small, at the extreme posterior end of the body.

The first parapodium has bluntly conical dorsal and ventral cirri and small tufts of neuro- and notopodial setæ. In a parapodium from the middle of the body the neuro- and notopodia are widely separated and protrude noticeably from the side of the body, while the portion which unites them is hardly more elevated than the general body surface. The prominent dorsal cirrus and the setal tuft protrude from an oval depression at the end of the above-mentioned cylindrical elevation. The neuropodial setæ protrude from a similar oval depression on the apex of the cylindrical neuropodium. The small ventral cirrus lies just ventral to this depression.

The notopodial setæ are all very long, slender, and sharp-pointed. The neuropodial ones are in a dense tuft, all essentially similar in form, but a few are larger than the others. Each (Fig. 12) has near the end a short blunt marginal tooth, beyond which the seta tapers to a blunt point. These ends are darker in color than any other part of the seta.

Hipponoe is an uncommon genus, the only other species thus far recorded from the eastern American coast being *H. gaudichaudi* Audouin et Milne-Edwards (McIntosh, 'Reports on the Scientific Results of the Voyage of H. M. S. "Challenger,"' XII, p. 30, Pl. I, fig. 5; Pl. IV, fig. 3; Pl. IIIA, figs. 13–17) which was taken one hundred miles south of Bermuda on a floating log. From the detailed description given by McIntosh it is evident that *H. elongata* is clearly a different species from *H. gaudichaudi*. This is shown in all details of structure but especially in the absence (in the former) of marginal protrusions on the dorsal setæ and of the hooks in the neuropodium which enable the annelid to attach itself to *Lepas* with which *H. gaudichaudi* lives commensally.

Collected in Porto Rico by R. W. Miner. The type and only specimen is No. 2067, in The American Museum of Natural History.

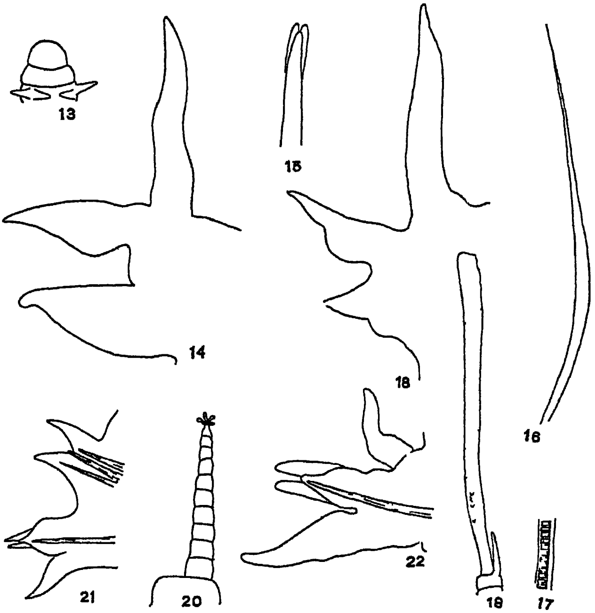
Scoloplos cirrata Treadwell

Aricia cirrata TREADWELL, 1901, 'Polychætous Annelids of Porto Rico,' Bull. U. S. F. C. for 1900, II, pp. 201–202, Figs. 54 to 57.

This should have been placed in the genus *Scoloplos* instead of

Aricia. Figure 54 of the original description shows the first somite to be as long as the two following. Comparison of the Jamaican specimen with the type is not feasible, but it seems certain that what was figured there as the first somite was really the first two, the constriction between them not having been clear. Another correction to be made is that the fine setæ retain their marginal teeth in posterior somites.

Collected at Montego Bay, Jamaica, in July, 1921, by A. L. Treadwell



Figs. 13 to 18. *Nainereis mutilata.* Fig. 13, head × 4; Fig. 14, anterior parapodium × 45; Fig. 15, neuropodial seta × 250; Fig. 16, slender seta × 185; Fig 17, camerated part of fin of slender seta × 250; Fig. 18, posterior parapodium × 45.

Figs. 19 to 21. *Goniada teres.* Fig. 19, head × 5; Fig. 20, prostomium × 20; Fig. 21, posterior parapodium × 22.5.

Nainereis mutilata, new species

Figures 13 to 18

Four specimens, all more or less mutilated. In the type, an anterior region comprising approximately 80 somites and 25 mm. in length is followed by a softened and disintegrated portion involving several somites, and behind this another region, about equal in length to the anterior one, continues to the pygidium. The peristomial width is barely 1 mm. and the body gradually widens posterior to this up to the twelfth somite which is 4 mm. wide. Behind the twelfth somite there is a gradual decrease in body width which continues to somite 30, and this width is continued posteriorly until near the very end.

The form of the prostomium depends on the position of the pharynx. In the type specimen, the pharynx is inverted, and the prostomium margin forms almost a half circle (Fig. 13). In others the prostomium is everted, and, under these conditions, the prostomial width is about twice that of its length. The protruded pharynx is in the form of two rather thick, flattened lobes, about as long as the prostomium.

The gills begin on the second setigerous somite, thus for this genus unusually near the anterior end of the body. The anterior gills are conical, sharp-pointed and not much larger than the dorsal cirri. In the anterior broader region of the body they are separated dorsally but in the narrower posterior regions they overlap on the mid-dorsal line. They are sharp-pointed throughout but posteriorly are less distinctly conical in outline. The dorsal surface of the body is flat throughout its entire extent, this being more noticeable in the anterior broader region than in the narrower. The ventral surface is rounded.

Anterior parapodia (Fig. 14) have asymmetrically lanceolate notopodial lobes which in the entire animal are directed almost vertically upward. The dorsal margin of the neuropodial lobe extends horizontally from the side of the somite, and the apex of the lobe is bluntly rounded. From just within the apex the vertical diameter of the lobe rapidly enlarges toward the body wall. The gill is situated on the dorsal surface of the body, at the edge of the neuropodium. Neuropodial setæ are numerous, arranged in general in a vertical row completely covering the anterior face of the setal lobe. A smaller tuft of longer setæ arises just in front of the notopodial lobe. There are two kinds of setæ in the neuropodium: one found only near the ventral end, rather heavy, apex bluntly rounded and covered by a hood (Fig. 15); the other variety is longer than the first and makes up the greater part of the tuft. For the greater part of their length they are straight but toward the apex they bend and then taper to an acute point (Fig. 16). On the convex margin of the bend is a marginal fin (not shown in Fig. 16). Throughout the greater part of its length this fin is camerated (Fig. 17), which structure does not extend on to the axis. The notopodial setæ are arranged in a wide-spreading fan. They are camerated like the above-described ones from the neuropodium.

In posterior parapodia (Fig. 18) the notopodium retains approximately the same character it had in anterior regions, while the neuropodium is relatively much smaller and is conical in outline. There is a rounded presetal lip. In the neuropodium are a few (three in the one drawn) heavy, straight, blunt-pointed acicula-like setæ which extend out between the lobes to near the apex of the conical one and a few (two in the one drawn) slender ones having the camerated structure. A very few of the latter type were all that could be found in the notopodium.

Collected by A. L. Treadwell at Montego Bay, Jamaica, in 1921. The type is No. 2070 in The American Museum of Natural History.

Goniada teres, new species

Figures 19 to 22

A single specimen incomplete posteriorly. About one hundred and fifty of the anterior somites have a length of 65 mm. The greatest body width is 1 mm. while the width of the body in the posterior region is scarcely more than one-third of that.

The protruded proboscis is 9 mm. long (Fig. 19). There are four short tentacles, each apparently two-jointed. For a distance along its basal portion about equal to the length of the prostomium the proboscis surface is smooth, while beyond this it is covered with minute papillæ. On either side, just beyond the smooth basal portion, is a row of ten V-shaped plates. These are not noticeably different from one another in size, but from the base toward the apex of the row they become progressively heavier and darker in color. I was unable to find any terminal teeth in the proboscis

The prostomium (Fig. 20) is only very slightly tapered toward the end and has ten indistinct joints. The peristomium is nearly twice as long as somite 2, and somite 2 is about equal in length to somite 3. From here posteriorly there is a gradual decrease in length. The first parapodium, on somite 2, is small; later ones showing a gradual increase up to the region of the fifteenth to the twentieth where they reach full size. On somite 57 the change from the one-lobed to the two-lobed condition characterizing the posterior portion of the body takes place. The anterior region of the body is pale brown, and in the region of somites 40 to 50 a faint dark brown patch appears on the body wall dorsal to each parapodium. At the point where the notopodium first appears this patch abruptly becomes circular in outline and much darker in color. A narrow band of a slightly paler color runs across the dorsal margin of the somite from one of these pigment areas to the other. At this same place, the dorsal cirrus, the end of the setal lobe of the notopodium, and the ventral cirrus become deeply pigmented, while the whole of the neuropodium becomes darker in color. Ventrally there is a similar spot near each parapodial margin and a median ventral row of very small dots.

A parapodium from the posterior end of the fragment (Fig. 21) has a notopodial lobe in the form of a sharp cone, quite similar in outline to the dorsal cirrus but heavier than it. In the neuropodium are two slender postsetal lobes, longer than the presetal, which is hemispherical in outline, but at the outer margin prolonged into a slender tip. Between the anterior and posterior lips is a vertical row of slender compound setæ. A single acicula lies in the neuropodium and several in the notopodium. The ventral cirrus is large and conical fully as long as any setal lip. It is densely pigmented, the pigmentation extending medially over the body surface. The neuropodial setæ are very slender and have a glassy texture, the terminal joint flattened, narrowing gradually to an acute point and minutely toothed along one margin. This terminal portion is longer than that part of the basal which protrudes from the body surface. There are no setæ in the notopodium, but there are several aciculæ whose apices protrude slightly from the surface.

In anterior somites only the neuropodium is present. This (Fig. 22) has two long cylindrical posterior lips and an anterior one which is about two-thirds as long as these but broader at the base and more definitely narrowed toward the end. The dorsal cirrus is small, the ventral one large. There is a single tuft of compound setæ.

Collected at Montego Bay, Jamaica, July, 1921, by A. L. Treadwell. The type is No. 2068 in The American Museum of Natural History.

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NEW SOUTH AMERICAN SPECIES OF DOLICHOPIDÆ

By M. C. Van Duzee

In the present paper there are twenty species described as new, all but two of which are from the S. W. Williston collection now in The American Museum of Natural History, New York City. Two of these species were without locality label, but are no doubt from South America, probably taken in Brazil. The types are in The American Museum of Natural History.

Condylostylus denticulatus, new species

Length, 4 mm.

Male.—Face wide, only a little narrowed below, bare, its suture near apical third, upper part shining green, lower portion blue, moderately white pollinose; front shining green with blue reflections and numerous long white hairs; palpi black with black bristly hairs and a few pale ones on the edge; proboscis dark yellowish-brown. Antennæ black, the joints of nearly equal length; longest bristle on second joint one and a half times as long as antenna; third joint somewhat triangular, as long as wide, arista dorsal, bare, about as long as width of head; beard white, long and abundant.

Thorax, scutellum, and abdomen shining green with blue reflections, incisures of abdomen very narrowly black, its bristles rather long and numerous; hypopygium rather small, black, its claspers yellow, about as long as hypopygium, with a cluster of long black hairs near the middle and short black appendages at tip, which have minute teeth or very short spines on inner edge.

All the coxæ and femora wholly black; fore coxæ with long white hair and black bristles at tip; femora with long white hair below; fore and middle tibiæ dark yellow, more brown at base; hind tibiæ dark yellowish-brown, with a row of eight or ten slender bristles on basal two-thirds of lower anterior surface, which are three times as long as diameter of tibia, and a row of about thirty hairs on lower posterior surface, which are twice as long as diameter of tibia and become a little shorter at tip; middle tibiæ with two long bristles on anterior surface and another at tip; fore tibiæ with four bristles on upper posterior surface, which increase a little in length; fore and middle tarsi dark yellow, almost brownish yellow, hind tarsi brown; fore basitarsi with long dense pile below; middle basitarsi with four pairs of little bristles below, which are about as long as diameter of joint; hind tarsi slender, not at all widened toward the tip; fore tarsi one and a half times as long as tibia; length of fore tibiæ as 65, middle 92, posterior as 133; joints of fore tarsi as 53–17–12–6–6; middle pair 70–27–14–10–6; of posterior pair as 59–26–19–9–5. Calypters, their cilia, and the halteres black.

Wings wholly grayish hyaline; costa with only short hair; cross-vein oblique; fork of fourth vein at an angle of about 60° with basal part of fourth, length from cross-vein to fork as 40, from fork to wing margin as 29, last section of fifth vein as 24 and cross-vein as 38.

FEMALE.—Face, thorax and scutellum almost wholly blue; front with rather short blackish hairs, longest bristle on second antennal joint about as long as antenna; fore tibiæ with four bristles on posterior surface; middle tibiæ with the same two long bristles on anterior surface as in male, also two smaller bristles nearer base on upper anterior surface, three below and two at tip; hind tibiæ with five small bristles on anterior surface and a row of hairs on lower posterior edge, which are scarcely as long as diameter of tibia; color of legs, feet and venation of wings about as in the male.

TYPES.—Holotype, male, allotype, female, taken at Rio de Janeiro, Brazil, in August; S. W. Williston collection.

This is very much like *goetghebueri* Parent and *panamensis* Van Duzee. From the former it differs in having the hypopygial lamellæ straighter, with a cluster of long black hairs near the middle and slender black appendages at tip, which have minute teeth on inner edge. The lamellæ of Parent's species are very slender, elbowed, and have only a few very short hairs on the edges of apical half; in this the fore tarsi are only one and a half times as long as their tibiæ, while in *goetghebueri* the fore tarsi are twice or three times as long as their tibiæ. From *panamensis* it differs in having only four bristles on posterior surface of fore tibiæ, not six as in that species, and the hypopygial lamellæ differ, as in *panamensis* there is a small, clavate, yellow appendage near tip of the lamellæ, and the first joint of all tarsi is much shorter in *denticulatus* than in *panamensis*.

Condylostylus brevipedis, new species

Length, 5 mm.

MALE.—Face wide above, narrow below, green, almost covered with white pollen; palpi black with white hairs and black bristles; front blue, shining, the blue extending on the sides of the face; antennæ black, longest bristle on second joint not as long as last two joints of antenna taken together, third joint about as long as wide; beard white, not long or very abundant.

Thorax and abdomen green, scutellum and first three abdominal segments mostly blue; first three abdominal segments with a few rather long white hairs on lower part of sides; hypopygium blackish, small, its claspers blackish, about as long as height of hypopygium, slightly enlarged at tip and fringed with rather long hairs on one side.

Coxæ black, anterior ones with a few very short white hairs and one or two black bristles; femora greenish black, with rather short, white hairs below; fore and hind tibiæ yellow, extreme tips of posterior tibiæ a little brown; fore tibiæ with one rather long, slender bristle near middle of lower posterior surface; hind tibiæ with a small bristle on anterior surface at basal fourth; fore tarsi (Fig. 17) with first joint yellow with a long bristle at apical fourth and a shorter one at middle, hairs on lower surface nearly twice as long as diameter of joint; hind tarsi wholly black, thick with long hair, third joint short, not at all enlarged, narrower than second; hind tibiæ about one and one-third times as long as first three joints of hind tarsi; middle tarsi missing in the type; length of fore tibiæ as 90, hind ones as 166; joints of fore tarsi as 90–24–20–15–8. First three joints of hind tarsi as 75–35–8 (Fig. 18). Calypters and their cilia black; halteres pale yellow.

Wings grayish with the usual brown cross-bands united back as far as the third vein; brown on costa beginning considerably beyond tip of first vein and reaching tip of fork of fourth vein; first cross-band rather narrow, scarcely reaching hind margin of wing; fork of fourth vein at an angle of about 70° with basal part of fourth vein, both sections of fork straight, fourth vein from cross-vein to fork as 53, from fork to wing margin 21, last section of fifth vein as 17, of the cross-vein 41.

TYPE.—Male, taken at Rio de Janeiro, Brazil, in August; S. W. Williston collection.

This belongs in the group which includes *uniseta* Becker, but seems to be distinguished by the long second joint of hind tarsi together with the short third joint, which is not at all enlarged but cylindrical and scarcely one-fourth as long as second.

Condylostylus crassitarsis, new species

Length, 5 mm.

MALE.—Face rather wide, covered with white pollen when viewed from above; face and front green; palpi black with black bristles and pale hairs; proboscis yellow; antennæ black, longest bristles on second joint about as long as antenna, third joint small, rounded, arista dorsal, about as long as height of eye; beard white, short and scanty.

Thorax and abdomen shining green, scutellum and first three abdominal segments with blue reflections, last four abdominal segments with bronze reflections, base of segments black; venter with a few short, white hairs; hypopygium small, reddish brown, its claspers short, straight, tapering.

Coxæ and femora black; extreme tips of coxæ and of fore and middle femora, fore trochanters, all tibiæ and fore basitarsi yellow, middle and hind basitarsi yellowish brown; fore and middle tarsi from tip of first joint and whole of hind tarsi blackish; fore coxæ with moderately long but not abundant white hair, and two long black bristles near tip; fore tibiæ with three slender bristles on lower posterior surface, which are of nearly equal length, the longest about as long as second joint of fore tarsi; middle tibiæ with three small bristles on upper anterior and three small ones on upper posterior surface of basal half, besides those at tip; hind tibiæ with three small bristles on basal half of anterior surface; fore tarsi with two bristles on apical half of lower surface of first joint, the one nearest middle as 8, the one near tip as 12, hair on lower surface of all joints rather long; first two joints of middle tarsi without special hair or bristles; hind tarsi (Fig. 16) stout, first joint with six inconspicuous little bristles among the long hair on lower surface, third joint slightly widened, fourth and fifth more conspicuously widened, the last nearly round; length of fore tibiæ as 98, bristles on posterior surface as 22 to 27; joints of fore tarsi as 94–31–21–15–8; first two joints of middle pair as 125–28; joints of posterior pair as 85–33–16–11–7, width of fourth joint as 8, of fifth 7. Calypters brown with black cilia; knobs of halteres pale yellow.

Wings grayish, basal half of second vein yellowish; the usual brown cross-bands united back to third vein, also united along fourth vein; the brown on the costa begins half-way from tip of first vein to the cross-vein and extends to tip of fork of fourth vein; there is an oval hyaline spot in first band between third and fourth veins, which nearly forms a break in the cross-band, also a small elongated triangle near costa with its base just back of tip of second vein and extending half-way to tip of third vein; hairs on the costa strong, a little curved, not erect, but the costa might almost be said to be ciliated; fork of fourth vein forming an angle of about 60° with basal part of fourth vein, its upper bend rounded; fourth vein from cross-vein to fork as 58, from fork to wing margin 25, cross-vein 36, the last section of fifth vein as 18.

TYPE.—Male, taken at Rio de Janeiro, Brazil, in July: S. W. Williston collection.

This is very much like *uniseta* Becker, but the bristles on posterior surface of fore tibiæ are longer and much more slender, first joint of fore tarsi with two large bristles and the joints of the tarsi of somewhat different proportional length.

Another male from Corumba, southern Brazil, is probably this species, but is too much broken to be sure. One of the fore basitarsi of the type has no bristle below, but it may have been broken off.

Condylostylus bisinuatus, new species

Length, about 6 mm.

MALE.—Face wide above, narrow below, suture near the middle, green, opaque with white pollen on lower two-thirds, rounded below; front shining green with blue reflections; proboscis yellow; palpi black with long white hair and one black bristle; antennæ black, bristles on second joint about as long as antenna, third joint rounded, scarcely as long as wide; arista dorsal, nearly bare, about as long as the thorax; beard white, moderately abundant but not very long.

Thorax and abdomen green with blue reflections, last three abdominal segments dark purple; second segment broadly dull black in the middle, this black extending narrowly forward in the middle to base of segment; third and fourth segments dull black on basal half, scutellum with two pairs of equally large bristles; bristles of abdomen rather short, its hair black, on lower part of the sides there are quite numerous, but short, white hairs. Hypopygium (Fig. 2) and its appendages black, lamellæ with a few short hairs.

Coxæ and femora black, white pruinose; fore coxæ with moderately long white hair and one black bristle near the middle; fore and middle femora with moderately long white hair below, the middle pair very slightly narrowed or indistinctly notched before the middle, the white hair at this point short; hind femora with a few long white hairs below; narrow tips of fore and middle femora and all tibiæ yellow; middle and hind tibiæ slightly brown at base and tip; middle tibiæ with five hairs above near base, which are twice as long as diameter of tibia, and three slender bristles below, on second fourth, which are three times as long as diameter of tibia; hind tibiæ without bristles; fore tarsi (Fig. 1) yellow, last joint black, first joint one-fourth longer than tibia, last four joints taken together three-fifths as long as first, first joint bent a little upward then downward towards tip; it has seven long slender bristles on one side and shorter stiff hairs on apical two-thirds of other side, the basal third with long fine hairs on the same side, fifth joint flattened and widened, oval (middle and hind tarsi missing in type); joints of fore tarsi as 100–26–16–8–11; fore tibiæ as 74, middle tibiæ as 156 and hind 205. Calypters and their cilia brown; halteres yellow.

Wings grayish with two dark brown cross-bands, united along the costa to third vein and narrowly along fourth vein, the first band is rather wide and reaches hind margin of wing at tip of fifth vein; on the costa the brown begins at tip of first vein and reaches tip of third vein, filling half of the cell back and beyond the fork of fourth vein, leaving the tip of the wing narrowly gray, the hyaline space between the cross-bands rather narrow; front of wing from base to tip of first vein and back to third vein pale brownish; fourth vein from cross-vein to fork as 74, from fork to wing margin 20, fork of fourth vein extending backward more than half-way to cross-vein, then sharply curved forward, running straight to wing margin; cross-vein as 40, last section of fifth vein as 20, and bent quite sharply toward hind margin of wing.

TYPE.—Male, taken at Chapada, Brazil.

In Abbe O. Parent's key to the North and South American species of this genus (Annales de le Société Scientifique de Bruxelles, (B) XLIX, part 1, p. 84, January 31, 1929) this would run to couplet 8 in group V, species *bifimbriatus* Aldrich. In that species the first joint of fore tarsi is straight and without very long bristles and the third joint longer than the second, while in *bisinuatus* the first joint of fore tarsi is bisinuate and with several bristles as long as second tarsal joint which is much longer than third.

Condylostylus latimanus, new species

Length, 4.5 mm.

MALE.—Face quite narrow below, suture at its middle, lower part green, part above the suture and the front violet, viewed from above the face is nearly opaque with white pollen; palpi black; proboscis dark yellow; antennæ black, its joints of about equal size, bristles on second joint as long as two last joints taken together, third joint somewhat, but very obtusely, pointed at tip, arista inserted above the tip, but distinctly dorsal, nearly bare, not as long as width of head; beard whitish, rather short and scanty.

Thorax and abdomen green with blue reflections, scutellum violet with two pairs of large bristles; dorsum of thorax shining, pleura white pruinose; bristles of thorax and abdomen short; incisures of abdomen a little yellowish, last two abdominal segments purple; hypopygium (Fig. 3) black, its outer lamellæ yellow, long, ribbon-like, fringed with long delicate hairs on lower edge and short and more scattering ones on upper edge.

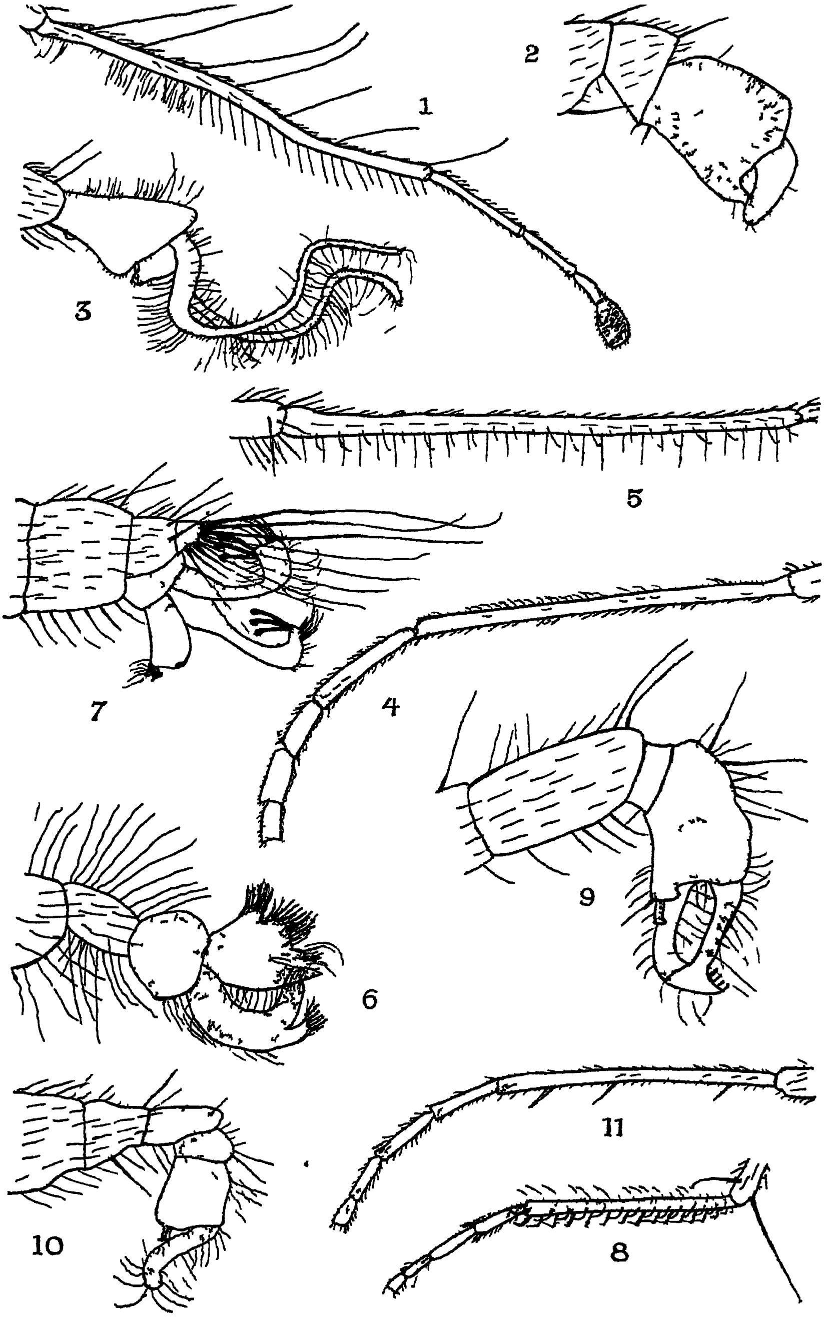
Fore coxæ brownish yellow with white hair and two black bristles near tip; middle and hind coxæ and trochanters black; all femora and tibiæ yellow; apical third of hind femora blackish; sides of middle femora at tip and most of basal half of hind tibiæ brown; all femora with white hair below, which is not as long as width of femora; fore tibiæ wholly without bristles, their hair short; middle tibiæ with very small bristles at tip, also one long slender bristle below, which is one and one-fifth times as long as second joint of middle tarsi; hind tibiæ without bristles, but with a row of longer hairs on lower posterior surface, which are not quite as long as diameter of tibia; fore and middle tarsi blackish brown, but more or less yellowish at base; hind tarsi wholly black, the apical joints very slightly widened; fore tarsi (Fig. 4) gradually a little widened to tip of fourth joint, fifth slightly less widened than fourth; middle basitarsi (Fig. 5) with a row of about 27 delicate, straight, erect hairs on anterior surface, also a row of little, stiff hairs with their tips bent on lower anterior surface; length of fore tibiæ as 82, middle 96, and hind as 163; joints of fore tarsi as 92–26–14–11–8; middle pair as 123–30–20–11–8; hind pair as 85–31–19–12–9. Calypters and their cilia brown; halteres yellow with a brown spot on the knob.

Wings grayish with the usual two brown cross-bands united along the costa to third vein, which is considerably bent back at tip; the brown on the costa begins a little before the tip of first vein and extends almost to tip of third vein, filling two-thirds of the cell back of the fork of fourth vein; first cross-band rather narrow, extending nearly equally each side of cross-vein, scarcely reaching tip of fifth vein; fork of fourth vein reaching back one-third the way to the cross-vein; upper bend abruptly rounded, then running straight to wing margin a little before apex of wing; fourth vein from cross-vein to fork 60, from fork to wing margin as 21; last section of fifth vein as 20, cross-vein 40.

TYPE.—Male, taken in July, at Rio de Janeiro, Brazil; S. W. Williston collection.

This would run in Abbe O. Parent's table of species to *viridicoxa* Aldrich, in couplet 22, group I, but couplet 19 would have to be changed to read "all coxæ black, green or brownish"; it differs from *viridicoxa* in having the fore coxæ rather dark yellowish-brown, and the middle tibiæ with a long, erect bristle or spur below (as in *calcaratus* Loew) and in having the hypopygial lamellæ filiform; it differs from *complctus*

Fig.	1.	*Condylostylus*	*bisinuatus*, new species.	Fore tarsus of male.
"	2.	"	" " "	Hypopygium of male.
"	3.	"	*latimanus*, new species	Hypopygium of male.
"	4.	"	" " "	Fore tarsus of male.
"	5.	"	" " "	Mid tarsus of male.
"	6.	"	*difusus* Wiedemann.	Hypopygium of male.
"	7.	"	*ornaticauda*, new species.	Hypopygium of male.
"	8.	"	" " "	Mid tarsus of male.
"	9.	"	*setitarsis*, new species.	Hypopygium of male.
"	10.	"	*tenuitarsis*, new species.	Hypopygium of male.
"	11.	"	*trimaculatus*, new species.	Fore tarsus of male.



Becker, to which it is also closely related, in having the long spur on lower side of middle tibiæ at tip and one rather long slender bristle below; Becker's species has three very short bristles on middle tibiæ and no spur at tip below.

Condylostylus diffusus Wiedemann

Length, 5 mm.

MALE.—Face shining green, rather wide, without pollen, suture below the middle, lower part about as long as wide, rounded below. Front mostly blue, shining; palpi and proboscis black, former with black bristly hairs; antennæ black, longest bristle on second joint nearly twice as long as antenna, third joint somewhat triangular, about as long as wide; arista dorsal, not as long as width of head; beard whitish, abundant, but not very long.

Thorax and abdomen shining green with bronze reflections; scutellum with two pairs of large bristles; both dorsum and venter of abdomen with rather long, black hair; hypopygium (Fig. 6) black, its outer lamellæ yellow, broadly black on upper and apical margins, each lamella with two clusters of very black, bristle-like hairs and one cluster of pale hairs; they are cleft rather deeply near inner edge.

All coxæ and femora wholly black; fore tibiæ and tarsi yellow; middle and hind tibiæ and tarsi brown; fore coxæ with abundant and rather long white hair; all femora with abundant, long, white hair below; fore tibiæ with a row of five slender bristles on posterior surface, these of increasing length, the last twice as long as the first; middle tibiæ with two rather long, slender bristles and one small one on upper posterior surface and one long, slender one near base, also two at tip: hind tibiæ with several short, slender bristles on upper anterior surface; fore tarsi nearly twice as long as their tibia, first joint of fore tarsi with very dense, short, whitish pile below; middle tarsi with quite long, silvery-white hairs on upper surface of last two joints which are longer than diameter of joint, the first joint with a few minute spines below; hind tarsi plain, with rather long hair; joints of fore tarsi as 93–26–20–12–6; middle pair as 112–27–20–12–6; of posterior pair as 85–28–21–11–7; Fore tibiæ as 80, middle ones 112, length of hind ones as 143; all pulvilli rather small, white. Calypters, their cilia and the halteres black.

Wings grayish with the usual two brown cross-bands connected along the costa as far back as third vein, the brown of the bands darker in front of third vein, beginning on the costa before the tip of first vein and reaching tip of third vein; fork of fourth vein at nearly a right angle at base, but bending backward above, the upper bend broadly rounded; fourth vein from cross-vein to the fork as 51, from fork to wing-margin 27, last section of fifth vein as 27, cross-vein 50.

Redescribed from one male, taken in July, at Rio de Janeiro, Brazil; S. W. Williston collection.

Condylostylus distinctus, new species

Length, 5 mm.

MALE.—This form is very nearly like *diffusus* Wiedemann, but has no white hair on the last two joints of middle tarsi. It has all parts of nearly the same color as in that species except that the hypopygial lamellæ are darker, but they have the same groups of black hair as in *diffusus.* The bristles on the tibiæ and the white hair on the lower surface of the femora are the same and the legs have the same white pulvilli; the form of fore tarsi and short pile on lower surface of the basitarsi are the same; the measurements of the sections of the wing-veins are almost like those of *diffusus;* the wings differ in having the basal part of the fork of fourth vein straight and the brown on the costa beginning at or a little beyond the tip of first vein; the proportional length of the joints of the tarsi and tibiæ differ considerably. In *distinctus* the fore tarsi are one and three-fourths times as long as the tibiæ and the first joint is a little shorter than the remaining four taken together; in *diffusus* the fore tarsi are almost twice as long as tibia and first tarsal joint nearly one and a half times as long as the remaining four; the hind tarsi are a very little shorter than the tibia in this and a little longer than tibia in *diffusus.*

Length of fore tibiæ as 90, middle ones as 127, hind as 175; joints of fore tarsi as 76–32–24–15–8; middle pair as 107–32–22–10–6; width of last joint of middle tarsi as 5; joints of posterior tarsi as 97–31–22–11–8. Calypters, their cilia and the halteres black.

TYPES.—Holotype, male, and three male paratypes, all taken in July, at Rio de Janeiro, Brazil; S. W. Williston collection.

This would seem to be the same as *diffusus* Wiedemann, but it has no white hair on the last two joints of the middle tarsi of any of the four type specimens; this white hair is very conspicuous in *diffusus.* The form of the hypopygial lamellæ seems somewhat different but they are not spread out enough for me to be sure. Both these forms are very much like *furcillatus* Parent, described from specimens taken in Costa Rica, but that species differs in having only one bristle on posterior surface of fore tibiæ, and the hypopygial lamellæ are cleft almost to the petiole, forming two nearly equal parts, the outer part would be nearly round if it were not cleft, and it has no clusters of black hair, which are so conspicuous in this species.

Condylostylus ornaticauda, new species

Length, 4 to 4.5 mm.

MALE.—Face with numerous hairs, which are mostly black, but mixed with shorter, delicate white ones, face and front green or blue, shining; palpi black with white hair and black bristles: proboscis yellow; antennæ black, longest bristle on second joint on lower surface and one and two-thirds as long as antenna, third joint rounded at tip, scarcely as long as wide; arista dorsal, bare, scarcely as long as width of head; beard abundant, rather short, brownish gray.

Thorax and abdomen green with bronze reflections, usually the scutellum and three basal segments of abdomen blue; incisures of abdomen broadly black; scutellum with two pairs of bristles; bristles of thorax and abdomen moderately long, tip of abdomen with very long bristles. Hypopygium and its appendages black (Fig. 7), claspers long with three finger-like appendages at tip, which is enlarged and bears many long hairs.

Coxæ black, fore coxæ with abundant white hair and two black bristles; femora green with long white hair below; tips of fore and middle femora, all tibiæ and fore basitarsi yellow, remainder of fore and whole of middle and hind tarsi black; fore tibiæ with a row of longer hairs on lower anterior edge and three bristles on upper posterior surface; middle tibiæ with three rather long bristles below, one at basal sixth, one at basal third and one near middle; one above at basal third, one curved one near tip on upper anterior edge and an erect spur below near tip, which is two-thirds as long as first tarsal joint; hind tibiæ without bristles; fore tarsi with last joint very slightly widened; middle tarsi (Fig. 8) with a row of little bristles below, which are bent at right angles near the middle, a row of stiff, curved hairs on lower posterior surface and a row of hairs on anterior surface, all these fully as long as diameter of joint; hind tarsi stout with last two joints rounded and nearly as wide as long; length of fore tibiæ as 70; of middle ones 100, joints of fore tarsi as 50–13–12–6–6, middle ones as 54–16–13–6–5; of posterior pair as 50–16–13–7–7, width of apical joints as 6. Calypters brown with black cilia; halteres yellow.

Wings grayish; third vein bent back a little at tip; fork of fourth vein at right angles to fourth, but rounded almost from base to tip, from cross-vein to fork as 38, from fork to wing margin as 26; last section of fifth vein as 22, cross-vein as 33, oblique.

FEMALE.—All femora and tibiæ wholly yellow; all hairs on the face white; bristles on second antennal joint not longer than the antennæ; middle tibiæ without a spur below; hind tibiæ with several bristles; all tarsi plain; otherwise as in the male.

TYPES.—Eleven males and twenty-nine females. The holotype, male, allotype, female, and thirty-seven paratypes were taken at Rio de Janeiro, Brazil, in May, July, and August; one male paratype was taken in April, at Piedra, Brazil.

This species belongs to the *caudatus* group of species; the male differs most strikingly from all others of the group in having the tips of the three-fingered hypopygial appendages much enlarged and bearing long black hairs on the side, and the face has the hairs mostly black and stiff.

Condylostylus setitarsis, new species

Length, 5 to 6 mm.

MALE.—Face green or blue, narrowed below, nearly opaque with white pollen when viewed from above; front shining green or blue; palpi black, with long black bristles and a few pale hairs; proboscis yellow, more brownish at base; antennæ black, longest bristle on second joint twice as long as the antenna third joint small, about as long as wide; arista dorsal, nearly bare, about as long as width of head; beard not very long but quite abundant, white.

Thorax and abdomen green; scutellum and first three abdominal segments mostly or wholly blue, former with two pairs of large bristles, base of abdominal segments broadly black; venter yellowish brown with short white hair; hypopygium (Fig. 9) black, its lamellæ (Fig. 19) of moderate length, pale yellow, with black bristly hairs at tip, which are of moderate length, they also have some delicate, moderately long hairs on the sides.

Coxæ and femora black, fore coxæ with white hair and two black bristles; all femora with white hair below, which is longer than the width of femora; fore trochanters, narrow tips of fore and middle femora and all tibiæ yellow, hind tibiæ quite broadly brown at base and tip; fore tibiæ with a row of seven moderately long bristles on posterior surface, without bristles above; middle tibiæ with a row of seventeen bristles on anterior surface, one bristle on anterior surface near base, several at tip and three on basal fourth of posterior side; hind tarsi without bristles, but with a row of stiff hairs; fore and middle tarsi black from tip of first joint, the former with abundant but not very long hair, first joint also with dense, short, pale pile below, fifth joint a very slightly widened; middle basitarsi with three rows of cilia or bristles (Fig. 13), upper surface with a row of eight bristles, which are twice as long as diameter of joint, anterior surface with a row of about forty-five slender, erect hairs, which are nearly twice as long as diameter of joint and have their tips abruptly enlarged with minute spines on apical edge of the enlarged tips, the lower anterior edge with a row of about thirty-eight slender bristles which are fully three times as long as the diameter of the joint and are not erect, second joint with ten erect hairs with enlarged tips on anterior side and a row of about eight little bristles on lower anterior surface, fifth joint a little widened, not quite as wide as long; hind tarsi wholly black with long, dense hair, the last three joints widened and flattened; length of fore tibiæ as 94, of middle 125, posterior as 185; joints of fore tarsi as 90–26–18–11–7; middle as 141–25–20–8–7, posterior as 90–30–14–11–9, width of third joint as 10. Calypters brown with black cilia; halteres pale yellow.

Wings grayish with the usual brown cross-bands connected along the costa to a point a little back of third vein and narrowly along fourth vein, leaving a whitish, hyaline spot between third and fourth veins, the brown begins on the costa beyond the tip of first vein and extends nearly to tip of fork of fourth vein; the first cross-band covers the cross-vein and extends narrowly to tip of fifth vein, the second band extends a little back of fourth vein; fork of fourth vein bent backward at about a 55 degree angle with basal part of fourth vein, upper bend of fork rounded; third vein only a little bent back at tip, fourth vein from cross-vein to fork as 63, from fork to wing margin 27; last section of fifth vein straight and its length as 22, cross-vein as 44.

TYPES.—Two males, taken at Rio de Janeiro, Brazil, the holotype in August, the paratype in July; S. W. Williston collection.

This is the third species, so far as I know, in which the first segment of the middle tarsi bears a row of cilia with their tips enlarged and bearing minute hairs or blunt spines on apical margin. *C. ornatipes* Van Duzee was taken by Mr. Edwards in northeastern Argentina; it has long hairs on the hypopygial lamellæ, which reach nearly to the middle of the fourth ventral segment. The other two species have short or only moderately long hairs on the lamellæ; *terciliatus* Parent does not have the row of long slender bristles on lower anterior edge of middle basitarsi which are so conspicuous in this species, it also has distinct cilia above, not little bristles as in this species.

Condylostylus tenuitarsis, new species

Length, 5 mm.

MALE.—Face and front shining green, the face narrow below, with considerable white pollen, suture near the middle; palpi black with pale hair and black bristles; proboscis dark yellow; antennæ black, longest bristle on second joint as long as the antenna, third joint rounded, scarcely as long as wide, arista dorsal with short pubescence, slender, about as long as width of head; beard short, white.

Thorax green, posterior part of dorsum and the scutellum blue, the latter with two pairs of nearly equally large bristles; abdomen green, first two segments with blue reflections, the following segments broadly black at base, third, fourth and fifth segments with coppery reflections; bristles of abdomen rather short; hair on venter moderately long, whitish; hypopygium (Fig. 10) black with basal part more purple, its outer claspers black, slightly enlarged at tip when viewed from behind.

Coxæ and femora black; fore coxæ with moderately long, white hair and one long black bristle; all femora with moderately long white hair below; tips of fore coxæ, fore trochanters, narrow tips of fore and middle femora, all tibiæ and fore and middle basitarsi yellow; narrow tips of hind tibiæ and whole of hind tarsi brown; fore tibiæ with five slender bristles on posterior surface, these are twice as long as diameter of tibia, they have no bristles on upper surface; middle tibiæ with a row of twenty bristles on anterior surface, which are not very stout but twice as long as diameter of tibia, also a row of six on posterior surface, extending from near the base to a little beyond the middle, these are shorter and more slender than those on anterior side; posterior tibiæ without bristles; fore basitarsi with five minute bristles below; middle basitarsi with a row of ten little spines on upper surface and a row of slightly fusiform hairs on lower anterior surface, which are recumbent and not as long as the hairs on upper surface; third and fourth joints of hind tarsi fully as wide as the preceding joint, fifth joint a little narrower; length of fore tibiæ as 92, middle 126, hind pair as 171; joints of fore tarsi as 96–26–21–13–7; middle pair 134–22–20–11–6; posterior pair as 83–30–17–12–9. Calypters and halteres brown, cilia of former black.

Wings grayish with the usual two cross-bands united along the costa as far back as third vein, the brown on costal margin beginning considerably beyond tip of first vein and reaching the tip of the fork of fourth vein; fork of fourth vein making an angle of about 60° with basal part of fourth vein; fourth vein from cross-vein to fork as 60, from fork to wing margin 27, cross-vein as 36, last section of fifth vein 21.

TYPES.—Holotype, male, and one male paratype, taken in April, at Piedro, Brazil; S. W. Williston collection.

This is a slender species with short, slender bristles on posterior surface of both fore and middle tibiæ, middle tibiæ with a row of twenty bristles on anterior surface; fore and middle basitarsi with a row of little spines and middle basitarsi also with an inconspicuous row of fusiform hairs.

This form would run to *uniseriatus* Becker, but the row of cilia on the middle basitarsus consists of twelve bristles on lower anterior surface, which are much longer than diameter of basitarsus in *uniseriatus*, while in *tenuitàris* the ciliation on the upper surface of middle basitarsi is composed of eight to ten minute spines which are shorter than diameter of joint, and with a row of slightly fusiform hairs on lower anterior surface.

Condylostylus trimaculatus, new species

Length, about 5 mm.

MALE.—Face rather narrow below, its suture a little above the middle, seen from above it is opaque with white pollen, face and front blue-green, vertex not deeply excavated; palpi black with white hairs and black bristles; proboscis dark yellow; antennæ black, one long bristle on second joint one and a half times as long as antenna, third joint somewhat triangular, but rounded at tip, arista dorsal, about as long as width of head; the beard consists of only a few short white hairs.

Thorax and abdomen green, posterior part of thorax, scutellum and abdomen with blue reflections, the latter with narrow yellowish incisures; scutellum with two pairs of nearly equally long bristles, anterior margin of thorax white pollinose, pleura silvery-white pollinose; bristles of thorax and abdomen rather short. Hypopygium reddish brown, its lamellæ black, somewhat triangular, three times as long as wide at base.

Coxæ and femora dark reddish-brown; anterior surface of fore coxæ with white hairs, inner edge black-haired, tip with several black bristles; femora with a few rather short white hairs below; fore and middle tibiæ yellow, hind tibiæ light brownish-yellow, with a row of stiff black hairs on lower posterior surface; upper surface of middle tibiæ with a pair of bristles near base, one bristle near apical third and two or three at tip, below with one bristle near the middle, all these bristles of about equal length and nearly twice as long as diameter of tibia; fore tibiæ without bristles; fore and middle tarsi brownish, first joint more yellowish, hind tarsi dark brown, first joint with many little spines below (last four joints broken off in type); fore tarsi (Fig. 11) with three equally long bristles on lower posterior surface, these are as long as last tarsal joint; otherwise the fore and middle tarsi are plain; length of fore tibiæ as 75, middle 115, and hind pair as 140; joints of fore tarsi as 67–15–16–12–7; middle pair 84–14–13–7–6; first joint of hind tarsi as 37. Calypters brown with black cilia; halteres wholly yellow.

Wings grayish with three brown clouds (Fig. 12), one at tip of second vein, one covering fork of fourth vein and extending to tip of third vein, the other on the cross-vein; fourth vein from cross-vein to fork as 46, from fork to wing margin 22, last section of fifth vein 18, and the cross-vein as 41.

TYPE.—Male taken in August, at Rio de Janeiro, Brazil; S. W. Williston collection.

It is possible that specimens of this form may be found with the brown spots on the wing united into the usual two cross-bands, connected along the costa. *C. trimaculatus* seems to come nearest to *uniseta* Becker, in that there is only one large bristle on first joint of fore tarsi, although there may be one or two small ones nearer the base.

Condylostylus rubrocauda, new species

Length, 12 mm.

MALE.—Face wide above, a little narrowed below, green, blue in the middle, lower part opaque with grayish-white pollen, bulging, suture near the middle; front blue, violet in the middle, shining; palpi black with white hair and long black bristles; proboscis yellow; antennæ (Fig. 14) black, third joint brown, rounded, second joint with short bristles; arista wholly bare, as long as width of head, appearing white against a dark background; beard white, short.

Dorsum of thorax shining green, with bronze reflections; acrostical bristles large; scutellum with two pairs of equally large bristles; abdomen green, base of first four segments yellow, it has short black hair, except a few very short white ones on the sides; venter yellow with a few short black hairs; hypopygium dark reddish, outer lamellæ blackish, elongate triangular, with long hairs on one edge and at tip.

Fore coxæ wholly yellow, nearly bare in front, except three large, black bristles; middle and hind coxæ reddish with a large black bristle; middle ones a little blackened on outer surface; femora and tibiæ yellow, tips of hind femora narrowly black above; hind tibiæ quite broadly brown at tip; fore tibiæ without bristles; middle tibiæ with two, one near the base and one near middle; hind tibiæ with one large bristle near base; femora with only short hair, except a few longer pale ones on lower surface of fore pair; fore tarsi plain, slender, yellow with tips of joints blackened; if my measurements are correct (the articulations are not easily distinguished) their joints are as 160–13–8–10–9; their tibiæ as 132. Calypters and halteres yellow, the former with white cilia.

Wings (Fig. 15) grayish with the usual cross-bands united back to third vein, the whole front of wing is more or less brown from costa to third vein; first cross-band a little interrupted between third and fourth veins, but reaching hind margin of wing at tip of fifth vein, the second band covering the whole of the fork of fourth vein.

TYPE.—Male, taken in April, at Piedra, Brazil; S. W. Williston collection.

This is one of the species that makes the dividing of the genus *Psilopus* unsatisfactory; it has four large bristles on the scutellum and long acrostical bristles as in the genus *Condylostylus*, but the calypters bear white cilia as in *Sciapus:* the arista is also almost as near subapical as dorsal, which might be thought by some to allow putting it in the genus *Chrysosoma*. *C. rubrocauda* would run to *brevis* Becker in Abbe O. Parent's table of species, couplet 3, group I; it differs from that species in having the hypopygial lamellæ elongate triangular, whereas in *brevis* the lamellæ are oval

Diaphorus (Lyroneurus) willistoni, new species

Length, 3.5 mm.

MALE.—Face and front green, of nearly equal width, their sides nearly parallel, but the front very slightly wider, face covered with pollen, which extends on to the sides of the front, this pollen is white when viewed from in front, more yellowish brown when seen from above; palpi yellow, black at base and covered with white pollen; antennæ black, third joint somewhat reniform, wider than long, but rounded on outer end, arista apical, pubescent; lower orbital cilia and the rather abundant beard white.

Thorax and abdomen bright green; prothorax with several small, white bristles above fore coxæ; fore part of dorsum of thorax with yellowish pollen; pleura white pollinose; abdomen with blackish incisures and black hair, a few short, whitish hairs on the sides; bristles at tip short; hypopygium small, blackish, with small, somewhat triangular, yellowish-brown lamellæ, fringed with white hair.

All coxæ black with yellow tips; anterior surface of fore coxæ with white pollen and a few small white hairs, one small black bristle at base and a row of five longer ones at tip; all femora green with rather wide yellow tips; trochanters and tibiæ yellow, extreme tips of hind tibiæ brown; all tarsi yellow at base, fore and middle ones blackish from tip of first joint, hind pair black almost to the base; all femora with a row of short pale hairs below; fore tibiæ with one bristle above near base, below with distinct, rather long and somewhat erect, black hairs on their whole length, these hairs extend along the first three joints of their tarsi, but are scarcely as long as diameter of joints; middle tibiæ with one large bristle near basal fourth of anterior surface, this bristle is as long as second joint of fore tarsi; there are also a pair of smaller bristles above near middle; middle tarsi plain; hind tibiæ with two pairs of bristles above, one near base and the other near middle, they also have rows of rather long, stiff hairs on both anterior and posterior surfaces and extending their whole length, these are not as long as diameter of tibia; hind basitarsi with a long erect bristle near base, below, which is fully as long as second joint of fore tarsi and very slightly curved, they also have a row of small bristle-like hairs, the four last joints have dense hair and the row of little bristles on the side; joints of fore tarsi as 39–14–14–8–8; middle pair as 50–20–13–7–5; of posterior pair as 35–22–14–7–7. Calypters, their cilia and the halteres yellow.

Wings (Fig. 20) grayish, veins brown; costa only a little thicker beyond tip of first vein; a brown cloud fills in the tip of the wing, from costa to third vein and from before tip of second vein to tip of third; venation about as in *simplex*, Loew, but last section of fourth vein only a little bent.

TYPES.—Two males: holotype without a locality label; paratype taken at Rio Nor.

This species belongs to the *simplex* group (*Lyroneurus*) which has the venation very much alike and is the fourth species having a brown cloud at tip of wing. Two of the species have the sides of second and third abdominal segments yellow, *apicalis* Becker and *maculatus* Parent; *apicalis* has a blackish ring before the tip of hind femora, while *maculatus* has no such ring. *Adustus* Wiedemann has the costa very much enlarged beyond tip of first vein and the fourth vein more bent than in this form, the wing also has a brown streak before fourth vein, which is not found in this species.

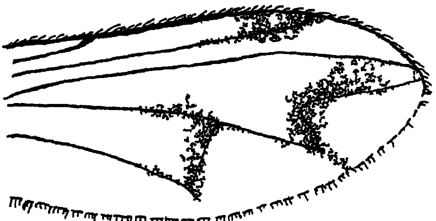
Dr. Becker made *chabybæus* Roder a synonym of *adustus* Wiedemann, but Abbe O. Parent redescribed *chabybæus* from the type in 1929. It does not have the distinct cloud at tip of wing as in the other four species, but has the space in front of third vein uniformly tinged with brown, and lacks the erect bristle at base of hind basitarsi.

CHRYSOTUS Meigen

Of the five species of *Chrysotus* described here one belongs to the group separated by Dr. Becker under the generic name *Achradocera*, while the other four species would all fall in the first four couplets of the key to the South American species of *Chrysotus* (part 5, of the 'Diptera of Patagonia,' published by the British Museum, March 22, 1930, page 27) which I have revised to receive them. There are no species omitted in this key as it is now.

1.—All femora and hind tibiæ yellow on basal half, black on most of apical half; all tarsi black from tip of first joint.................. *pictipes* Becker.
All femora yellow, posterior pair may be black on apical part................ 2.
All femora black or metallic on basal third or more, or one pair almost wholly black.. 9.
2.—Inner hypopygial appendages long, ribbon-like, pale yellow, and circularly emarginate at tip................................ *caudatus*, new species.
Hypopygial appendages short as usual.................................... 3.
3.—Antennæ with at least the first joint yellow............................ 4.
Antennæ wholly black... 6.
4.—Face very narrow, green; hypopygium with the central organ long and flattened. *caudatus*, new species.
Eyes contiguous on the face; central hypopygial organ short, sometimes invisible... 5.
5.—First antennal joint yellow, second and third black, sometimes the hind femora a little brown above at tip........................... *picticornis* Loew.
First, second, and narrow base of third joint yellow, third joint mostly black; hind femora blackened above at tip.............. *longiventris*, new species.
6.—Eyes contiguous, almost obliterating the face; femora conspicuously black at tip.. 7.
Face narrow below, eyes not quite touching; all femora wholly yellow...... 8.
7.—First joint of hind tarsi nearly twice as long as second; hind tibiæ and tarsi with numerous, long, bristly hairs above; hind tibiæ one and a half times as long as tarsi.................................. *setosus*, new species.

Fig. 12. *Condylostylus trimaculatus*, new species. Wing of male.
" 13. " *setitarsis*, new species. Mid basitarsus of male.
" 14. " *rubrocauda*, new species. Antenna of male.
" 15. " " " " Wing of male.
" 16. " *crassitarsis*, new species. Hind tarsus of male.
" 17. " *brevipedis*, new species. Fore tarsus of male.
" 18. " " " " First three joints of hind tarsus.
" 19. " *setitarsis*, new species. Hypopygial lamellæ of male, from above.
" 20. *Diaphorus willistoni*, new species. Wing of male.
" 21. *Chrysotus caudatus*, new species. Hypopygium of male.
" 22. " *tumidus*, new species. Antennæ of male.
" 23. " " " " Fore tibiæ and basitarsus of male.
" 24. " " " " Fore basitarsus of male, from above.
" 25. *Syntormon rotundicornis*, new species. Antenna of male.
" 26. " " " " Hypopygium of male.
" 27. " " " " Hind tarsus of male.
" 28. *Neurigona grossicauda*, new species. Hypopygium of male.
" 29. *Paraclius plumicornis*, new species. Antenna of male.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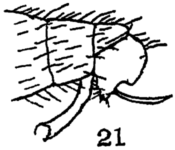
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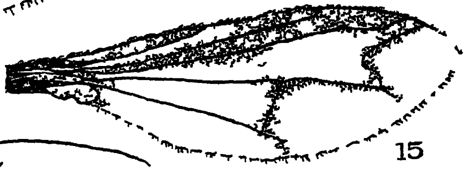
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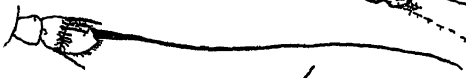
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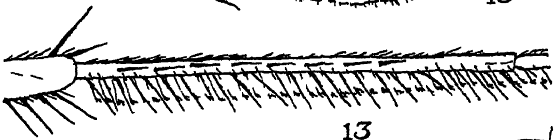
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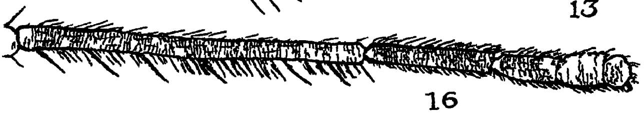
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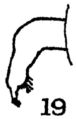
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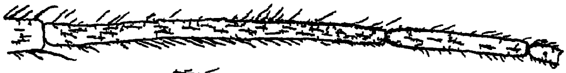
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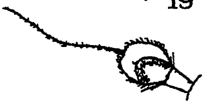
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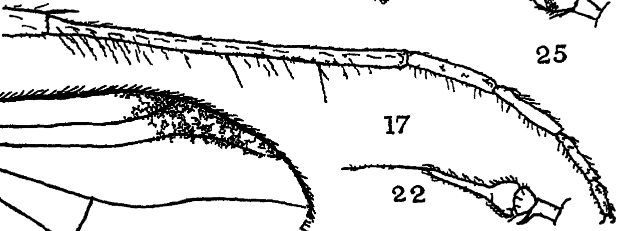
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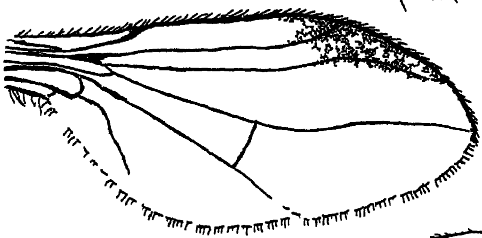
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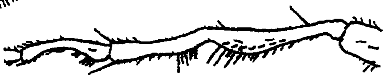
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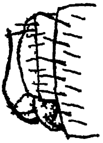
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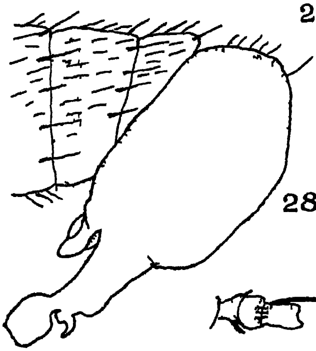
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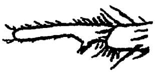
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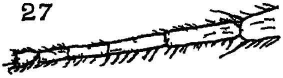
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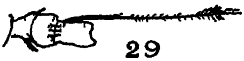
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First joint of fore tarsi slightly shorter than second; hind tibiæ and tarsi with the bristly hairs on upper surface less dense and shorter; posterior tibiæ one and two-thirds times as long as tarsi................*parvipalpus*, new species.

8.—Hypopygial appendages small, wholly yellow; abdomen with two rather strong hairs at tip; all pulvilli rather large; all coxæ yellow; palpi dark (West Indies; Bolivia)...*paradoxus* Aldrich.

Hypopygial appendages black; no special hairs at tip of abdomen; pulvilli small; middle and hind coxæ black; palpi yellow (Peru).
flavipalpis Van Duzee.

9.—Palpi unusually large...10.

Palpi normal in size, or nearly so...11.

10.—Palpi yellowish-white (mother-of-pearl color), leaf-like, twice as long as wide; antennæ yellow; thorax golden green, thickly covered with brown pollen (Peru)...*imitator* Becker.

Palpi yellow with silvery-white tip, three times as long as wide; antennæ blackish brown, first segment yellow; thorax shining blue-green, without pollen (Argentina)...*palparis* Becker.

11.—Antennæ yellow, second and third segments black above; tip of arista with a small lamella; halteres and palpi yellow; face white, eyes not touching (Peru)...*laminatus* Becker.

Antennæ wholly black...12.

12.—Legs wholly black; cilia of calypters black...13.

Legs not wholly black...16.

13.—Halteres, calypters, their cilia, and face black; wings brownish black, especially in front; length, 3.5 mm. (Colombia)....................*exceptus* Becker.

Halteres and calypters yellow; wings grayish or pale brownish.............14.

14.—Hind femora and tibiæ much thickened in middle, and together with their basitarsi clothed with rather long hair; face and upper side of palpi white (Peru)...*tumidipes* Becker.

Hind femora and tibiæ not much thickened, not so hairy; palpi black.......15.

15.—Front dull brown; face gray; third antennal segment rather large; hind tibiæ on whole length of anterior surface with long, delicate cilia; length, 1.6 mm. (Peru)...*viridis* Becker.

Front metallic black, shining ; face dull black; third antennal segment rather small; hind tibiæ without cilia; length, 1.8 mm. (Ecuador).
unicolor Becker.

16.—Third antennal segment large at base, with a very long point and rather short apical arista; figure 22. (Becker's genus *Achradocera*)..............20.

Antennæ formed as usual, sometimes moderately elongate.................17.

17.—Middle or hind tibiæ modified; all coxæ and femora black...............18.

All tibiæ plain...19.

18.—Eyes touching, facial triangles above and below white; hind tibiæ narrowed before tip, of normal size and with a large, curved spur (Bolivia).
subapicalis Becker; cf. also *calcaratus* Van Duzee.

Eyes contiguous, leaving only a small blackish-gray facial triangle above and below; hind tibiæ with a large lobe at tip (Ecuador)....*laciniatus* Becker.

Eyes separated, face gray; hind tibiæ narrowed at tip for a short distance this narrow part preceded by a short, blunt, bristly projection (Peru). *soleatus* Becker.

19.—Eyes separated, face gray; palpi grayish yellow; all tibiæ yellow (north Argentina)....................................*metatarsatus* Becker.

Eyes contiguous, face above and below blackish, usually almost obliterated by the eyes; palpi black; hind tibiæ and tarsi wholly black or brown (North America, reported by Becker from Ecuador)..........*obliquus* Loew.

20.—Front femora fully half, hind femora wholly black; apical part of front femora, whole of middle femora, all tibiæ and tarsi, except last segment, yellow; hypopygium with leaf-like, outstanding, dark lamellæ (Paraguay; Colombia; Trinidad)..................................*femoralis* Becker.

Front femora yellow with a black line above or on upper part of one side; middle femora wholly yellow or a little blackened at base; hind femora wholly black or green...21.

All femora black on at least basal third (middle tibiæ modified in all three species)...26.

21.—Hind femora of middle tibiæ modified ....22.

Legs normal, except that sometimes last three segments of hind tarsi are a little modified...23.

22.—Face opaque, brownish yellow; middle tibiæ swollen below; middle basitarsi bent, concave below (Virgin Islands)............*excavatus* Van Duzee.

Face green with gray pollen, ground color not concealed; hind femora arched above with a concave emargination below (western North America). *arcuatus* Van Duzee.

23.—Face and front opaque, with brownish-yellow pollen......................25.

Face and front green, with thin white pollen...........................24.

24.—Third segment of hind tarsi distinctly concave below, fourth slightly so, fifth very slightly widened (southern Chile)............*chilensis* Van Duzee.

Hind tarsi normal, all segments cylindrical (North America)..*barbatus* Loew.

25.—Hind tibiæ and tarsi blackish-brown; hypopygium without distinctly visible appendages; front femora with a narrow line of black on upper edge; hind basitarsi somewhat longer than second segment (north Chile). *angustifacies* Becker.

Hind tibiæ yellow with extreme tip brown, tarsi dark brown; hypopygium with distinct, rounded, blackish lamellæ; front femora rather broadly black on upper edge of anterior surface; first segment of hind tarsi nearly twice as long as second (central Chile)...................*edwardsi* Van Duzee.

26.—Front and face dull brown; cilia of calypters black; hind femora considerably thickened at base (Costa Rica)...................*meridionalis* Becker.

Face green, with slight pollen, ground color not concealed; cilia of calypters yellow, black in *tuberculatus;* hind femora very much thickened at base and with a cluster of long stout bristles on anterior surface...........27.

27.—Face green, with thin white pollen; hypopygial lamellæ yellowish; front femora with basal two-thirds, middle with basal half and whole of hind femora green or black; tibiæ yellow, broad base and narrow tip of hind pair blackish, front tibiæ with apical half more or less infuscated (Virgin Islands). *contractus* Van Duzee.

Face green; hypopygial lamellæ blackish; front femora black with yellow tips; front tibiæ pale yellow with a distinct black ring at middle and a black tip; middle femora with nearly basal half, hind pair wholly black; hind tibiæ yellow with basal third blackish, their tips narrowly deep black (Peru)..................................... *shannoni* Van Duzee.

Face green with thin white pollen; femora green or black, fore pair with apical fourth, middle with apical third yellow, hind pair wholly black; all tibiæ wholly yellow (Bolivia)...................... *tuberculatus*, new species.

Chrysotus caudatus, new species

Length, 1.7 mm.

MALE.—Thorax and abdomen shining green with bronze reflections; bristles of thorax black; abdomen depressed, hairs and bristles on first abdominal segment wholly yellow, on the other segments mostly yellow, but with black hair mixed among them; hypopygium (Fig. 21) black, small, but conspicuous, with small, black outer appendages and a pair ot long, thin, ribbon-like, pale yellow inner appendages, which are circularly emarginate at tip, with one long hair; penis long and thin.

Fore coxæ and fore and middle femora and tibiæ yellow; middle and hind coxæ black on basal half or more; hairs and bristles of all coxæ yellow or whitish; hind coxæ with two bristles; fore femora with long pale hairs below, which are shorter than width of femora, middle femora with shorter pale hairs below; fore tibiæ with one small bristle near base and with rather long hair, the ventral hair somewhat erect; middle tibiæ with two bristles on upper surface, near first and second thirds; fore tarsi yellow, infuscated at tip, just equal to their tibiæ in length; joints of fore tarsi as 15–6–5–3–5.

Wings nearly hyaline, veins brownish yellow, sections of costa as 35–54–20–11; second and third veins and last section of fourth vein straight; fourth parallel with third and ending in apex of wing; both sections of fifth vein as 31, cross-vein as 8; anal angle of wing prominent, the wing being of somewhat equal width.

Another male taken at the same place appears to be the same species, except that the long inner appendages are concealed; it has the thorax, abdomen, penis and fore tarsi the same. This paratype has the face very narrow, the eyes almost touching in the middle, face green with a little gray pollen; palpi yellow; front green; first antennal joint yellow, others missing; posterior femora and tibiæ wholly yellow; middle and hind tarsi yellow, a little darkened at tip; all tarsi plain; hind tarsi a little shorter than their tibia, their joints as 21–9–6–5–5.

TYPES.—Holotype, male, and one male paratype, taken at Piedra, Blaena, Bolivia.

The holotype is chosen because it shows the inner appendages of the hypopygium, although it is in poor condition, having lost its head and both posterior legs and the middle tarsi. Have described it because of its remarkable hypopygial appendages.

Chrysotus setosus, new species

Length, 2 mm.

MALE.—Eyes contiguous, obliterating the face; palpi moderately large, yellow; front blue-green, quite shining; antennæ wholly black, third joint very small, somewhat triangular with the three sides nearly equal; arista apical, its pubescence long; lower orbital cilia white; occiput green, shining.

Dorsum of thorax and abdomen shining green, abdomen with black hair, some of the hairs have a yellowish reflection; pleura black, white pollinose; hypopygium small, brown, mostly concealed.

Fore coxæ largely blackish, but apical half and much of anterior surface more or less yellowish, anterior surface with a few yellowish hairs and black bristles at tip; middle and hind coxæ black with yellow tips, middle ones with a dense brush of hair at tip; femora, tibiæ, and tarsi yellow, tips of tarsi blackish; apical half of hind femora black and with a row of four large bristles on lower anterior surface; middle tibiæ with two bristles on basal half of upper anterior surface, the one nearest the base longer than first joint of hind tarsi; fore femora with a row of about twelve bristles on lower posterior surface, extending their whole length and becoming hair-like at base; fore tibiæ with a row of bristly hairs on whole lower anterior surface, which are as long as width of tibia and extend the whole length of the basitarsi; hind tibiæ with very numerous bristles on upper, anterior surface, these are as long as diameter of the rather thick tibia, the bristles extending the whole length of the tarsi but becoming shorter toward the tip; lower surface of tarsi with long, delicate, very dense hair, delicate hairs extending on the tibiæ, but rather scattering even at tip and becoming short and placed far apart before reaching the apical third, there being only about twelve on whole of apical third; fore and middle tarsi with dense hair; fore tibiæ and tarsi of equal length; hind tibiæ about one and two-thirds times as long as their tarsi; fore tibiæ as 37, middle 44, and posterior ones as 50; joints of fore tarsi as 15–7–6–4–4; middle pair as 18–10–10–4–5; posterior ones 11–7–7–3–3. Calypters and knobs of halteres yellow, cilia of former black.

Wings nearly hyaline, but broken in the holotype.

Female.—Face moderately wide, narrowed below, white pollinose; palpi a little smaller than in male, yellow; front shining blue; antennæ as in the male; color of legs and feet about as in the male, except that the hind femora are wholly blackish; fore femora with three bristles near tip on posterior side, tibiæ and tarsi about as in the male, but the hairs shorter, bristles of middle tibiæ as in the male; hind tibiæ and tarsi without the numerous bristles above, the tibiæ having only the usual bristles; hind tarsi with the hair below dense, but not as long nor abundant as in male; hind tibiæ of the same length as in the male, joints of their tarsi as 13–9–5–5–5; fore tibiæ and tarsi each of the same length as in the male; wings with third and fourth veins parallel, a little arched; last section of fifth vein as 30, the cross-vein as 11.

Types.—Holotype, male, and allotype, female, taken in Brazil; S. W. Williston collection.

Chrysotus parvipalpus, new species

A small, stout species, with contiguous eyes, black antennæ with small third joint; legs yellow with apical fourth of hind femora black. Length, 1.8 mm.

Male.—Eyes contiguous, obliterating the face; palpi small, yellow; front shining green; antennæ wholly black; third joint small, arista with long pubescence.

Dorsum of thorax and abdomen shining green with bronze and coppery reflections; hypopygium small with small, black appendages.

Fore coxæ yellow with a few black hairs; femora yellow with apical fourth of posterior ones black and with four black bristles on the side, the third from the tip the longest; all femora with moderately long yellow hairs below; all tibiæ yellow, their hairs mostly yellow, except posterior pair, which have long bristly hairs; fore tibiæ with one small bristle above near base and small bristles below; middle tibiæ with one large bristle; tarsi yellow, darker at tip, their hair mostly yellow, hair on posterior pair long; length of fore tibiæ as 37, of middle and hind ones as 47; joints of fore and middle tarsi as 18–7–7–5–3; of posterior pair as 15–19–7–5–5, last joint of hind ones very slightly widened. Calypters and halteres yellowish brown, cilia of former black.

Wings hyaline; third and fourth veins parallel beyond the cross-vein, which is situated before the middle of the wing, anal angle of wing moderately prominent; last section of fifth vein two and a half times as long as cross-vein.

TYPE.—Male, probably from Brazil; S. W. Williston collection.

This is very much like *setosus*, new species; it differs in having the first joint of hind tarsi a very little shorter than the second; the bristly hairs on hind tibiæ and basitarsi are short and less numerous in this; hind tibiæ one and a half times as long as their tarsi and only the apical fourth of hind femora is black in this form.

Chrysotus tuberculatus, new species

Length, 2.2 to 3 mm.

MALE.—Face moderately wide, narrower below, green with a little white pollen; palpi yellow; front green, rather dull; antennæ (Fig. 22) black, formed as usual in the *barbatus* group, but with a curved spur on inner apical corner of first joint; lower orbital cilia white; beard rather long, almost silvery white, some of the hairs slightly flattened.

Thorax green, scutellum usually blue; abdomen green with bronze reflections; hypopygium small, mostly concealed, its appendages small, yellowish brown.

Coxæ and trochanters black; fore coxæ with pale hairs; trochanters with black bristles at tip; femora green or black, anterior pair with apical fourth, middle with apical third or half yellow; fore femora with a row of five, middle with seven moderately long bristles on apical half of posterior surface, both with rather long pale hairs below; hind femora very much thickened at base and with a cluster of very long, black bristles on anterior surface near the middle; all tibiæ wholly pale yellow; anterior tibiæ without bristles, but with rather long hair, those below nearly erect; middle tibiæ (Fig. 23) with two swellings below and a deep emargination between them, they have several quite large spines below on each side of this emargination, basal part with another row of very short spines on apical half; hind tibiæ with three moderately large bristles on upper posterior and two on upper anterior surface and several at tip; tarsi blackened from second joint; anterior and posterior pairs with rather long hair; middle basitarsi (Fig. 24) bent, concave below, enlarged at base and with a little tubercule near base, which bears several minute black spines, this tubercule is seen when viewed from above; last joint of middle tarsi nearly as wide as long and somewhat round in outline; fore pulvilli a little enlarged; fore tibiæ as 48, middle 55 and posterior as 68; joints of fore tarsi as 15–10–6–4–4; middle as 25–13–8–5–5; posterior as 19–14–7–5–6. Calypters and halteres yellow, cilia of former black.

Wings nearly hyaline, of nearly equal width, the anal angle forming nearly a right angle with hind margin of wing and sixth vein nearly parallel with it; cross-vein situated a little before the middle of the wing; last section of fourth vein straight and parallel with third, ending in apex of wing; cross-vein but little shorter than last section of fifth vein.

TYPES.—Seven males: holotype and three paratypes, although without locality labels, were taken with the three other paratypes at Piedra, Blaena, Bolivia; S. W. Williston collection.

This is one of the group for which Dr. Becker erected the genus *Achradocera*, describing three species: *femoralis*, *angustifacies*, and *meridonalis*. Loew described *barbatus*, and *tuberculatus* is the seventh described by the author (*excavatus*, *arcuatus*, *edwardsi*, *shannoni*, *chilensis*, *contractus*, and *tuberculatus*). *C. tuberculatus* is nearest *contractus*, but *contractus* has the apical half of fore tibiæ black or brown, also the hind tibiæ blackish at base and tip, while in *tuberculatus* all tibiæ are wholly yellow; the middle tibiæ have the emargination deeper in this and have longer spines below. The tubercle on middle basitarsi is sometimes difficult to see.

Chrysotus longiventris, new species

Length, 2 mm.

MALE.—Eyes contiguous, leaving only a small brown pollinose triangle above; palpi yellow, with several black hairs; front dark blue, scarcely shining; antennæ yellow, third joint almost an equilateral triangle, the point slightly rounded and with long hair; arista inserted just above the point; upper orbital cilia black, a few white cilia on the side orbits.

Dorsum of thorax bronze-green, not very shining; scutellum blue; pleura white pollinose; abdomen somewhat coppery, rather slender, depressed, its hairs mostly black, a few pale hairs on the sides and venter; venter black; hypopygium black, mostly concealed, with small, black, somewhat triangular outer lamellæ which are fringed with white hairs.

Fore coxæ wholly yellow with a few rather long yellow hairs; middle and hind coxæ yellow, blackened on basal half or more; femora and tibiæ yellow, tips of hind femora a little blackened above; tarsi yellow, brownish from tip of first joint; fore femora with a row of six black bristles on lower posterior surface; middle ones with a few pale hairs below and one preapical bristle; posterior femora with a row of three bristles on lower anterior edge; last joint of hind tarsi slightly widened; length of fore tibiæ as 26, middle 32, posterior as 37; fore tibiæ without bristles; middle tibiæ with two bristles, one at basal fourth and one at middle; hind tibiæ with several bristles above; last three joints of fore tarsi as 5–3–3; joints of middle tarsi as 17–7–6–3–4; of posterior pair as 12–8–5–4–4. Calypters, their cilia and the halteres yellow.

Wings grayish; third and fourth veins straight and parallel; last section of fifth vein very little curved, its length as 31; cross-vein as 7.

TYPE.—Male, without locality label, probably from Brazil; S. W. Williston collection.

Syntormon rotundicornis, new species

Length, 2.2 mm.

MALE.—Eyes contiguous, obliterating the face; palpi and proboscis black; front dark, but shining blue, almost violet; occiput green with a little brown pollen; antennæ (Fig. 25) black, first joint bare; second joint overlapping third to beyond its middle on inner side, the overlapping part being nearly round; third joint large, nearly round, arista apical, pubescent; lower orbital cilia white.

Thorax and abdomen dark but bright shining green with slight bronze reflections, fore part of thorax more coppery; hairs of abdomen abundant, rather long, black; hypopygium (Fig. 26) black with small black lamellæ, fringed with small hairs, inner appendages somewhat hook-shaped, central organ long, black, extending upward nearly to top of hypopygium.

Coxæ, legs, and feet wholly blackish with a slight reddish-brown tint and black hair and bristles; femora with a few little hairs below; bristles of hind tibiæ strong; hind tarsi (Fig. 27) with a few little bristles below on first two joints, these are not more than stout hairs and some of them have their tips bent at nearly a right angle, otherwise all tarsi are plain with rather long hair; joints of fore tarsi as 28–10–8–5–5; middle pair 28–12–9–7–4; posterior pair as 19–14–10–7–5. Calypters and halteres black, cilia of former formed of stout black hairs.

Wings a little grayish; third and fourth veins parallel, a little arched, fourth ending in apex of wing; last section of fifth vein as 25, cross-vein as 8.

TYPE.—Male, taken in Brazil.

This species is unusual in having third antennal joint round and in having the legs and feet wholly black. This is the third species known to me from America having the posterior basitarsi plain and without special bristles; *simplicitarsis* Van Duzee has the first two antennal joints yellow, third brown, long and pointed at tip; the other two species have the antennæ wholly black; *edwardsi* has the third antennal joint long and obtusely pointed at tip and legs yellowish, while *rotundicornis* has third antennal joint nearly round and the legs and tarsi blackish.

Neurigona grossicauda, new species

Length, 3.5 mm.

MALE.—Face very narrow, a little wider below, silvery white; front gray pollinose, vertex narrowly shining blue; occiput black with a little gray pollen; antennæ, palpi and proboscis yellow; lower orbital cilia white.

Dorsum of thorax dark yellow, pleura wholly pale yellow; depressed area before the scutellum blue, this color forms a large triangle in front of the depressed space, the apex of which reaches nearly to the middle of the mesonotum; posterior margin of the scutellum quite widely yellow; metanotum and lower surface of scutellum black; abdomen yellow, dorsum of second and following segments widely dull blackish in the middle at base, this black narrowing on the sides and shading into the yellow toward the hind margin of the segments; hairs on the dorsum mostly black, those on lower part of the sides yellow; hypopygium (Fig. 28) black on basal part, which is large, rounded, a little longer than wide, shining; apical part mostly yellow and somewhat smaller than basal portion, its outer lamellæ pale yellow, quite large (partly hidden in type).

All coxæ, femora and tibiæ yellow; middle tibiæ with a bristle at apical third of upper posterior surface and one near base on upper anterior edge, also two small bristles below; hind tibiæ with four bristles on upper posterior surface, one near base and the last at apical fourth, none below; fore tibiæ without bristles; tarsi slender, brownish yellow, scarcely darker at tip; middle tarsi with one or two minute bristles; hind basitarsi with a pair of bristles below at apical third; fore tibiæ as 111, hind ones as 152; joints of fore tarsi as 42–51–19–15–9; middle pair 95–36–26–14–8; posterior as 44–51–32–16–9. Calypters, their cilia and the halteres pale yellow.

Wings gray; third vein nearly straight; first vein reaching about half-way to cross-vein; last section of fourth vein nearly straight and parallel with third, its tip a little back of apex of wing; last section of fifth vein not quite twice as long as the cross-vein.

Female.—Colored like the male, except that the vertex is black like the front and with brownish-gray pollen; face a little wider, gray pollinose, but narrow for a female; middle tibiæ with three large bristles above, hind ones with five; scutellum greenish blue, the margin broadly yellow.

Types.—Holotype, male, and allotype, female, taken February 21, 1913, in British Guiana.

This is colored something like *signifer* Aldrich, which was described from St. Vincent, but the male of that species has the hypopygium club-shaped and wholly shining black.

Paraclius plumicornis, new species

Length, 2.5 mm.

Male.—Face narrow below, white pollinose; palpi small, yellow; antennæ wholly yellow (Fig. 29), third joint quadrilateral in outline with a notch at tip; arista dorsal, rather short, a little more than twice as long as antenna, short pubescent, except on apical fourth, where the pubescence becomes gradually longer then short again at tip, giving the arista the appearance of being enlarged at tip; lower orbital cilia yellow.

Thorax and abdomen green, not very shining, their hair and bristles black.

All coxæ, fore and middle femora and tibiæ and fore tarsi pale yellow, middle coxæ with three bristles on upper anterior edge, and a row of about ten little spines on the upper posterior surface, which are not as long as diameter of tibia; middle tibiæ with three large bristles on upper anterior surface; length of fore femora as 67, of their tibiæ as 46, tarsi one and one-fourth times as long as tibiæ, joints of fore tarsi as 26–11–9–6–6. Calypters and halteres yellow, cilia of former black.

Wings grayish; costa not enlarged; third vein straight; last section of fourth vein bent at its middle, arched from this bend to tip, so that it is concave posteriorly, its tip close to tip of third vein and far before apex of wing; cross-vein at right angles to fourth vein, its length as 16, last section of fifth vein as 18; anal angle of wing narrowed and not very prominent.

Type.—Male, taken at Pasagua; S. W. Williston collection.

It is with some misgivings that I have described this species, as the tip of the abdomen, middle tarsi and posterior legs are missing in the type, but the antennæ are of such unusual form that it seems to make the future determination of the species easy. The wing venation is typical of the genus *Paraclius*, as is also the form of the face; the fore tibiæ have the row of little spines or bristles on upper surface which are almost always found in the genus *Gymnopternus* Loew. I cannot see any hairs on upper surface of first antennal joint. It is, so far as I know, the only American species in the genus with the apical part of the arista enlarged in any way.

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NEW SOUTH AND CENTRAL AMERICAN DOLICHOPIDÆ

By M. C. Van Duzee

Of the fourteen species described in the present paper, seven are from the collection of Dr. S. W. Williston and were taken in South America, six species were taken by Dr. Harrison Dyer in Honduras, during the year 1917, and one is from Patagonia. All holotypes and allotypes are in The American Museum of Natural History.

Condylostylus sexsetosus, new species

Length, 6 mm.

Male.—Face wide, shining, its suture below the middle, upper part green, lower portion blue, almost violet, lower edge rounded and brownish-gray pollinose; front violet-blue, vertex yellowish, gray pollinose; sides of front with a few white hairs, vertex not very deeply excavated; palpi black with long, black, bristly hairs above and delicate yellow hairs below; proboscis brown; antennæ black, longest bristle on second joint nearly twice as long as antenna, third joint small, about as large as second joint, rounded at tip; arista dorsal, about as long as width of head; the short orbital cilia and the rather long, not very abundant beard white.

Thorax and abdomen violet-blue with very slight green reflections in some places; hairs on abdomen short and black, on sides toward apex long; hairs on first segment and venter long and yellowish white, venter with several slender black bristles among the hairs; on apical edge of last segment are two very long, wavy bristles on each side, which are more or less twisted together; hypopygium (Fig. 1) black with a long curved pedunculate segment, which bears several very long, wavy, slender hairs, its outer lamellæ long, yellow, rather broad with a branch near tip, which is not conspicuous, two minute teeth at tip and a cluster of short, blunt hairs on inner side.

Coxæ, trochanters and femora black, extreme tips of fore and middle femora and fore and middle tibiæ pale yellow; hind tibiæ yellowish brown, paler below with base and tip more black; fore and middle coxæ with moderately long white hair; all femora with long white hair below, that on anterior and posterior pairs as long as third joint of middle tarsi, those on middle ones a little shorter; fore tibiæ with six long slender bristles of increasing length on basal two-thirds, the one nearest base rather short, the longest at apical third as long as second joint of hind tarsi; middle and hind tibiæ each with one slender bristle of moderate length near apical fourth of anterior surface; all tarsi plain; fore and middle tarsi brown, yellowish at base; hind tarsi wholly black; joints of fore tarsi as 60–20–15–11–6; middle pair as 112–25–26–11–9; posterior pair as 78–29–20–10–8; fore tibiæ as 65, middle ones as 110, posterior pair as 135. Calypters dark yellow with brown cilia; halteres brown.

Wings grayish, veins brown; third vein bent back a little at tip; costa from humeral vein to tip of first vein as 115, from tip of second vein to tip of third as 30, between tips of third and fourth as 4; fork of fourth vein making less than a right angle with basal part of fourth, upper bend of fork not very broadly rounded; cross-vein very oblique; fourth vein from cross-vein to fork as 39, from fork to wing margin as 28; cross-vein as 44, last section of fifth vein about as 22.

FEMALE.—Like the male in color and venation of wing; fore tibiæ with four slender bristles of increasing length, similar to those on fore tibiæ of male, but a little shorter.

TYPES.—One pair, taken by F. J. Dyer, in Honduras: holotype, male, April 4, 1917, at Taecigalpa; allotype, female, December 19, 1916, at La Ceiba.

This species is related to *villosus* Parent, from which it differs in having six bristles on posterior surface of fore tibiæ and in having the third antennal joint rounded at tip; *C. villosus* has nine bristles on posterior surface of fore tibiæ and the third antennal joint is triangular and pointed at tip.

Condylostylus tenuimanus, new species

Length, 4 mm.

MALE.—Face green, its suture near the middle, wide above, narrow below, shining on upper part, dulled with white pollen below the suture, lower part with two long white hairs on each side near the orbits; front shining green with several long white hairs on each side; palpi black with yellowish-white hairs; proboscis yellow with long white hair. Antennæ black, longest bristle on second joint about twice as long as antenna, third joint rounded, about as long as wide, arista dorsal, about half as long as width of head; orbital cilia and beard white, several minute black cilia on upper orbits.

Dorsum of thorax shining green with bronze reflections; scutellum with four large bristles. Abdomen green with slight blue reflections, segments beyond second with wide black bands at base; venter and sides of first and second segments with moderately long white hair. Hypopygium and its appendages (Fig. 2) black, appendages finger-like, rather thick, I see only three of these but there may be two pair.

Fore coxæ and all femora green, middle and hind coxæ black, white pruinose; moderately wide tips of fore and middle femora, extreme tips of hind femora, all tibiæ and fore basitarsi yellow; fore coxæ with moderately short, white hair; all femora with white hair below, which is shorter than width of femora; fore tibiæ with two small bristles above, one near basal fifth, the other at apical third; middle tibiæ with two bristles on upper posterior edge, one near basal fourth and one near tip, below with three bristles on basal half and one long, erect one at tip; posterior tibiæ blackened at tip and with one bristle near basal fourth of upper anterior surface; fore tarsi very slender, brown from tip of first joint, plain; middle and hind tarsi black, middle ones with rows of short, stout, hooked bristles below, hind tarsi plain; fore tibiæ as 68, joints of fore tarsi as 42–14–11–6–6; middle tibiæ 98, tarsi as 54–15–11–5–4; hind tibiæ as 120, joints of their tarsi as 49–21–14–7–7. Calypters brown with black cilia; knobs of halteres whitish.

Wings grayish, without brown cloudings.

FEMALE.—Face with a few small white hairs on lower part and three longer ones on each side near orbits; longest bristle on second antennal joint scarcely as long as antennæ; all coxæ black; all femora, tibiæ and fore basitarsi yellow; proboscis black; palpi black with black bristles; joints of fore tarsi nearly as in the male; wings grayish; cross-vein perpendicular to fourth vein, fork at right angles to fourth vein, broadly rounded at upper bend; last two sections of costa as 39–3; fourth vein from cross-vein to fork as 37, from fork to wing margin about 23; cross-vein as 28, last section of fifth vein as 23 and nearly straight.

Types.—One pair taken by F. J. Dyer, in Honduras: holotype, male December 2, 1916, at La Ceiba; allotype, female, August 11, 1917, at Tegucigalpa.

This belongs to the *caudatus* group of species, having the same long, erect spur at tip of middle tibiæ, the same hooked bristles below on middle basitarsi, and the wing venation also nearly the same; it differs in the form of hypopygial appendages. In the male it differs also in having the face nearly bare; in the female the few hairs on lower part of face are much shorter than in most of the other species of the group.

Diaphorus abruptus, new species

Length, 2.5 mm.

Male.—Face and front of nearly equal width throughout, white pollinose; palpi small, black; occiput blackish green, so thickly covered with white pollen as to almost conceal the ground color; antennæ (Fig. 3) black, third joint cut off straight at tip, where there are little black hairs, arista nearly bare, inserted at upper corner of third joint; lower orbital cilia and the scanty beard white.

Thorax green, dulled with abundant white pollen. Abdomen green with slight blue reflections and thin white pollen, hairs on the dorsum black, those on the venter longer and whitish in certain lights; hypopygium small, with small black lamellæ and two stout, short, blunt bristles posteriorly.

Coxæ, femora, tibiæ, and tarsi black or green, knees narrowly yellow; fore coxæ with a few black hairs; femora with longer hair below; middle and hind tibiæ with a few bristles on upper surface; all tarsi plain; pulvilli of all tarsi distinctly but not greatly enlarged, whitish, nearly as long as fifth tarsal joint; joints of middle tarsi as 24–14–10–6–6; of hind pair as 19–18–12–8–8. Calypters, their cilia and the halteres whitish.

Wings grayish, veins pale yellow at base of wing, becoming yellowish brown towards apex of wing, costa pale yellow almost to tip of first vein; cross-vein near base of wing, almost opposite apical fourth of first vein.

Holotype.—Male, taken by F. J. Dyer, October 13, 1916, at La Ceiba, Honduras.

D. abruptus runs nearest to *aldrichi* Van Duzee and *similis* Van Duzee in the table of species in the Bulletin of the Buffalo Society of Natural Sciences, XI, page 165, couplet 31, but differs from both those species in having all tibiæ black and third antennal joint cut off straight at tip; in both the other species the third antennal joint has a point at upper, apical corner; also *aldrichi* has fore and middle tibiæ and *similis* has all tibiæ wholly yellow.

Diaphorus dyeri, new species

Length, 3 mm.

MALE.—Face of moderate width, brown; eyes contiguous on the front, lower frontal triangle brown, upper triangle mostly green; occiput green with a little white pollen; palpi black. Antennæ black, third joint small, rounded, not as long as wide, arista apical, pubescent; inferior orbital cilia white.

Dorsum of thorax shining green with blue reflections posteriorly and with a little brown pollen. Abdomen shining green with black hair on the dorsum; venter yellow at base with long pale hairs; hypopygium small, brown, with small brown lamellæ; bristles at tip of abdomen rather small.

Coxæ and femora black, tips of coxæ and the trochanters yellowish, fore coxæ with black hair; tibiæ wholly yellow; basitarsi yellow, all tarsi brown from tip of first joint; all pulvilli distinctly enlarged; middle tibiæ with one small bristle near base on anterior side; hind tibiæ with very small bristles; all tarsi plain; joints of fore tarsi as 46–16–14–7–7; of posterior pair as 49–23–15–7–9. Calypters yellow, their cilia and knobs of halteres whitish.

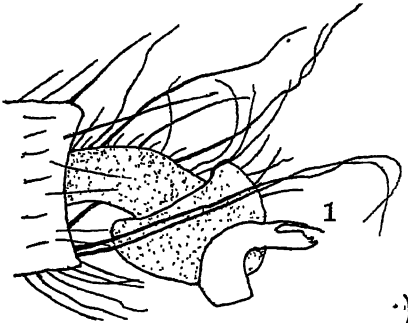
Wings a little grayish; veins brown; third and fourth veins rather far apart, nearly parallel beyond the cross-vein, but bent backward toward tips, fourth ending in apex of wing; cross-vein a little beyond the middle of the wing and considerably beyond tip of first vein.

FEMALE.—Face a little wider than in the male, grayish pollinose; palpi large, black with a yellow edge; front as wide as the face, gray pollinose, vertex blue; dorsum of thorax more grayish-brown pollinose than in the male; wings about as in the male, last section of fifth vein straight, a little longer than the cross-vein.

TYPES.—One pair: holotype, male, taken by F. J. Dyer, October 18, 1916, at La Ceiba, Honduras; allotype, female, taken at the same time as male.

This species is very much like *longinervis*, new species, described from Honduras, differing in having the cilia of the calypters fine, long and whitish, and the last section of fifth vein about as long as the cross-vein; in *longinervis* the cilia of the calypters are brownish and the last section

Fig. 1. *Condylostylus sexsetosus*, new species. Hypopygium of male.
" 2. " *tenuimanus*, new species. Hypopygium of male.
" 3. *Diaphorus abruptus*, new species. Antenna of male.
" 4. *Paraclius albopilosus*, new species. Hypopygium of male.
" 5. " *breviventris*, new species. Hypopygium of male.
" 6. " *fuscipennis*, new species. Hypopygium of male.
" 7. " *nigroterminalis*, new species. Hypopygium of male.
" 8. " " " " Fore tarsus of male.
" 9. " " " " Middle tarsus of male.
" 10. " *viridus*, new species. Hypopygial lamellæ of male.
" 11. *Pelastoneurus braziliensis*, new species. Hypopygial lamellæ of male.
" 12. " *plumicauda*, new species. Hypopygium of male.
" 13. " *ochreifacies*, new species. Hypopygium of male.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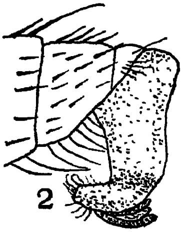
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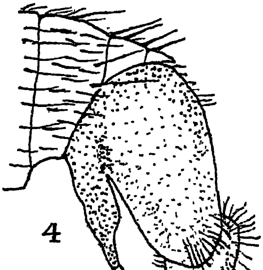
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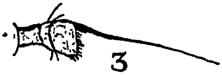
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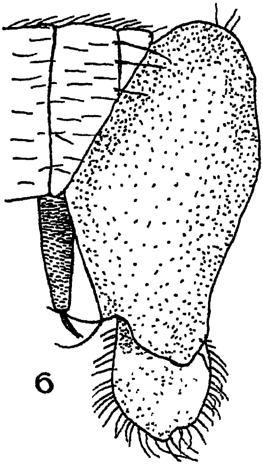
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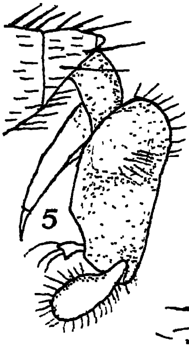
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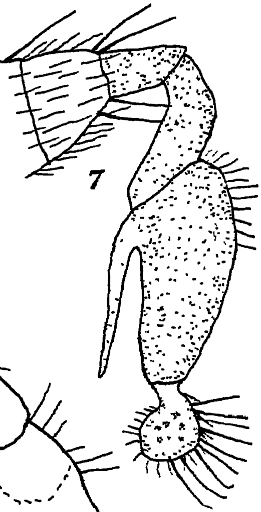
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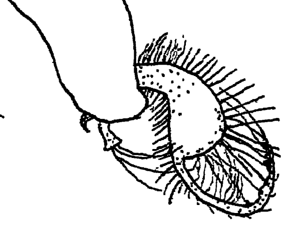
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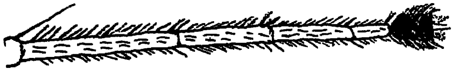
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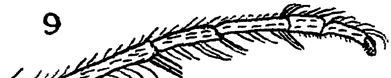
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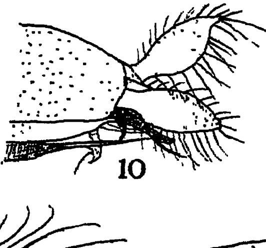
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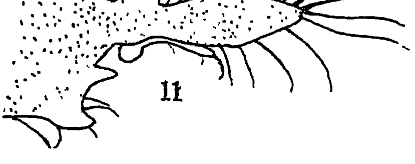
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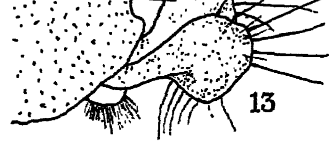
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of fifth vein twice as long as cross-vein. *D. funeralis* Parent, taken in Georgia, is also near these, but differs from both in having the palpi yellow; the palpi in both the others are black.

Diaphorus longinervis, new species

Length, 3 mm.

Male.—Face and lower frontal triangle brown, eyes contiguous on the front, upper frontal triangle and occiput green, latter thinly white pollinose; palpi brown; antennæ black, third joint small, rounded at tip, arista apical, pubescent; lateral and inferior orbital cilia white.

Dorsum of thorax green with a narrow, coppery line each side of acrostical bristles and just a little white pollen. Abdomen shining green with coppery reflections and black hair; hypopygium small, brown, its lamellæ small, brown.

Coxæ and femora black, fore coxæ with black hair; the black hairs on lower surface of the femora rather long; hind femora with three bristles below at tip and one preapical bristle on anterior surface; trochanters, tips of femora, all tibiæ and basitarsi yellow, tarsi black from tip of first joint; hind tibiæ with a row of close-set, stiff hairs on lower anterior surface; all tarsi plain; pulvilli of fore and middle tarsi enlarged, hind ones scarcely enlarged; joints of fore tarsi as 35–17–10–7–6; middle pair as 42–20–13–7–6; posterior pair as 28–22–13–8–6. Calypters yellow with brown cilia; knobs of halteres whitish.

Wings grayish; third and fourth veins nearly parallel beyond the cross-vein, both a little bent backward toward tip; last section of fifth vein straight, twice as long as cross-vein.

Female.—Wings as in the male; cilia of calypters yellow; pollen of face and front gray; palpi large, black, nearly twice as long as wide and rather pointed at tip; thorax with violet reflections; abdomen with blue reflections.

Types.—One pair: holotype, male, taken January 20, 1917, and allotype, female, taken December 2, 1916, at La Ceiba, Honduras, by F. J. Dyer.

This is much like *dyeri* new species, except that the cilia of the calypters are more brown and last section of fifth vein much longer.

Hydrophorus patagonicus, new species

Length, 4 mm.; of wing, 6 mm.

Female.—Checks moderately wide; about as wide as third antennal joint; face wide, a little narrowed above, face and palpi thickly covered with white pollen, the latter appears to have a yellowish ground color and has many white hairs; front opaque with brown pollen; occiput black with thick white pollen; antennæ black, third joint small, arista short, rather thick on basal half; the black orbital cilia descend to about the middle of the eye; beard white, quite long and abundant; one pair of postvertical bristles.

Thorax brown with brown pollen (in the type the dorsum is covered with a white substance which seems to be foreign matter); acrostical and dorsocentral bristles, except the last pair of dorsocentrals, small; scutellum with one pair of marginal bristles; propleuræ with long white hairs and one long, slender, black bristle above fore coxæ; sternopleura, hypopleura and metapleura each with a tuft of yellowish-white hairs. Abdomen green, dorsum with black hairs, sides with thick white pollen and short white hairs.

Coxæ colored like the pleura, blackish with thick white pollen; anterior pair with rather short white hair, which becomes longer at tip, without black bristles; femora and tibiæ greenish in color; middle and hind femora and tibiæ long, slender and straight; fore femora considerably thickened at base, tapering regularly to tip; lower posterior edge with a row of six long bristle-like spines, these are nearly three-fourths as long as thickness of femora at point of insertion; lower anterior edge with a row of small spines, both the rows of spines extend nearly whole length of femora; fore tibiæ rather stout, below with a projecting point extending toward femora and a row of about fifteen rather long spines below; all tarsi black; fore tarsi with long hair, the joints as 45–25–19–13–15; of middle pair as 61–33–25–18–16; hind pair as 63–39–28–21–18. Calypters yellowish brown with white cilia; halteres pale yellow.

Wings grayish, veins brown; first section of costa and first vein yellowish brown, almost yellow; last section of fifth vein as 17, cross-vein as 33; hind margin of wing conspicuously notched at tip of fifth vein.

TYPE.—Female, taken by Barnum Brown in southern Patagonia.

This is very much like *diminuatus* Beck, described from Buenos Aires, Argentina, but in *diminuatus* the hind basitarsi are fully twice as long as second joint, while in *patagonicus* they are scarcely one and two-thirds as long as second joint, and both rows of spines on fore femora extend the whole length, and the cheeks are moderately wide; otherwise the two species are almost alike.

Paraclius albopilosus, new species

Length, 3.2 mm.

MALE.—Face narrow in the middle, a little wider above and below, suture near apical fourth, reaching down nearly to lower margin of eyes, yellowish-white pollinose, lower edge rounded; front white pollinose, seen from above it is divided by a perpendicular black line; occiput blackish green, quite shining; first antennal joint black (other joints missing in type); lateral and inferior orbital cilia whitish.

Dorsum of thorax dark green with coppery reflections on anterior part; the white pollinose spot at the suture large, but not distinctly limited; humeri with a small spot of white pollen above and a reddish yellow spot below; pleura blackish green with thin gray pollen. Abdomen dark green, segments with apical margins shining black and large spots of white pollen on the sides; hypopygium (Fig. 4) short black, its lamellæ black, yellow at base with darker spots on the surface.

Coxæ yellow, anterior ones with stiff black hair and a row of five moderately large bristles at tip, middle coxæ mostly black on outer surface; femora and tibiæ wholly yellow; anterior and posterior tibiæ without bristles below; middle tibiæ with three large bristles on lower anterior edge; fore tibiæ slightly flattened and, glabrous on upper edge, but not widened, the flattened space widest at tip, nearly disappearing at the middle, this space is silvery-white pollinose and has minute silvery-white hairs near the tip, there are also two whitish bristles at tip; these white hairs are continued on upper posterior edge of the basitarsus and are nearly as long as diameter of joint; fore tarsi yellow, brownish from second joint; middle tarsi brown almost to base; hind tarsi wholly black; joints of fore tarsi as 30–10–9–6–7; middle pair as 43–22–16–9–8; posterior pair as 30–37–27–13–10; hind tarsi with a stout bristle near base on lower surface, which is not erect

Wings mostly broken off in type, but basal half gray.

TYPE.—Male, taken at Chapada, Brazil; S. W. Williston collection

This species is something like *albinus* Becker, from Bolivia, but in that species the coxæ are black and the hypopygial lamellæ of different form; this also has white hairs on fore tibiæ and basitarsi.

Paraclius breviventris, new species

Length, 2.3–3 mm.

MALE.—Face silvery white, wide, its sides nearly parallel, about one and a half times as wide as third antennal joint, its suture at apical third, lower part about as long as wide, lower edge straight, not quite reaching lower edge of eyes; palpi brown with pale hairs; proboscis black with black hair; front green, rather dull; antennæ reddish yellow, third joint mostly brown, rounded at tip, slightly longer than wide, arista with long pubescence, almost feathered; lateral and inferior orbital cilia sordid white.

Dorsum of thorax blue-green or green with coppery reflections in front, moderately shining; the black stripe above root of wing and the silvery-white spot of pollen at suture distinct; pleura greenish black with white pollen; abdomen green with dorsum more coppery, sides with white pollen which is divided into spots by the narrow black incisures, its hairs black, but appearing brown on the sides; hypopygium (Fig. 5) brown, petiolate, somewhat reddish below, hairs black, but those on the pollinose space on left side pale, its lamellæ oval, petiolate, whitish, inner edge very narrowly brown with yellow hairs; inner appendages yellow.

Coxæ, femora and tibiæ yellow; fore coxæ with black hair and three bristles at tip; hind femora slightly brown at tip above; posterior tibiæ more or less brown on apical fifth; fore tibiæ without a bristle below; middle tibiæ with two bristles below on anterior edge, one at first and one at second third; posterior pair with one bristle on lower anterior edge near apical fourth; fore tarsi with longer hair than usual, yellow, blackened from third joint; middle tarsi from tip of first joint and whole of hind tarsi black; middle basitarsi a little arched and with about twelve little spines below, the first and last of these spines longest; hind tarsi with spines below on first four joints; joints of fore tarsi as 32–10–8–8–7; of middle pair as 32–19–16–9–6; of posterior pair as 30–34–24–16–11. Calypters and halteres yellow, cilia of former black.

Wings grayish; third vein bent slightly backward at tip; last section of fourth vein bent quite abruptly just beyond the middle in the holotype, in the allotype a little before the middle, beyond the bend it is very concave posteriorly; last section of fifth vein arched, ending abruptly about two-thirds the distance to wing margin; the distance from cross-vein to wing margin as 12, cross-vein as 15; hind margin of wing distinctly notched at tip of fifth vein.

FEMALE.—Like the male in color and wing characters; face wider than in male; all tarsi with spines below, but these are less conspicuous than in male; first joint of middle tarsi not bent.

TYPES.—Holotype, male, allotype, female, without locality label; S. W. Williston collection.

This species comes near *ovatus* Van Duzee. In *ovatus* the hind femora and tibiæ are wholly yellow, in *breviventris* femora are brownish above at tip and their tibiæ are brown on apical fifth. The middle basitarsi in *breviventris* are distinctly arched, while they are straight in *ovatus*. In this form the hypopygial lamellæ are also more elongate oval.

Paraclius fuscipennis, new species

Length, 4.7 mm.

MALE.—Face narrow, a little wider above and below, whitish pollinose, its suture at apical third, lower part obtusely pointed at lower edge; palpi and proboscis brown, former with black hairs; antennæ brown, first joint hairy above, as long as third, white pollinose, third joint as long as wide, rounded at tip; arista with short pubescence, inserted at apical third; lateral and inferior orbital cilia whitish with several black bristles below the neck; front dark blue with patches of whitish pollen; occiput blue-green with white pollen along the posterior orbits.

Dorsum of thorax dark, shining brown with white pollen along the front, this pollen divided into four parts by shining brown stripes, seen from above the two middle stripes extend rather faintly along the rows of dorsocentral bristles to the scutellum, which is blue-green; pleura green with white pollen. Abdomen black, rather shining with brown hair, its sides almost without pollen; hypopygium (Fig. 6) black, a little dulled with brown pollen; outer lamellæ rather large, black with black hair; between the lamellæ are small, yellow organs with white hair on the edges, these scarcely show in the drawing; central organ thick with a short, slender portion at tip.

All coxæ, femora, tibiæ and tarsi black, trochanters yellowish, tips of femora narrowly dark yellow, tips of tibiæ a very little yellow; fore coxæ with black hairs; fore tibiæ with one very small bristle below near the middle; middle tibiæ with a larger bristle below beyond the middle, hind ones without a bristle below; all tarsi plain; joints of fore tarsi as 36–17–12–7–10; fore tibiæ as 70; joints of posterior tarsi as 37–52–34–20–14. Calypters dark yellow with black cilia; knobs of halteres brown, petiole yellow.

Wings tinged with dark brown from the costa to fifth vein as far as the cross-vein and from there on as far as fourth vein; third vein nearly straight, only slightly bent back at tip; last section of fourth vein bent near its middle, beyond the bend it is moderately concave posteriorly; last section of fifth vein curved, its length as 20, cross-vein as 27; hind margin of wing a little indented at tip of fifth vein.

TYPE.—Male, taken at Chapada, Brazil; S. W. Williston collection.

Nearly related to *tylophanus* Schiner, but in that species the front is wholly silvery-white pollinose and in *fuscipennis* it is bluish with thin white pollen.

Paraclius nigroterminalis, new species

Length, 3.7 mm.

MALE.—Face one and one-third times as wide as third antennal joint, silvery white, its sides nearly parallel, the suture indistinct and near apical fourth, lower part about as long as wide, lower edge straight; palpi and proboscis brown; front dull green; antennæ black, third joint yellow at base, about as long as wide, arista with long pubescence; lateral and inferior orbital cilia whitish.

Dorsum of thorax and scutellum dull blue-green with coppery reflections along the front; pleura black, white pollinose; velvety black stripe above root of wing not conspicuous; when viewed from above there is a large spot of white pollen at the suture. Abdomen shining green with black hair and large spots of white pollen on sides of segments; hypopygium (Fig. 7) black with two petiolate segments, its lamellæ nearly round, with a petiole, yellowish white with narrow brown border and a few brown dots on the surface; it has nine long, bristle-like hairs on outer surface and short hairs on inner edge.

Fore coxæ wholly yellow with black hair and four large bristles; middle and hind coxæ black; trochanters, femora and tibiæ yellow; fore tibiæ without a bristle below; middle tibiæ with two bristles below on middle third, hind ones with one rather small bristle near apical fourth; femora with only short hair below; fore tarsi (Fig. 8) wholly yellow, a little widened when seen from below, first joint with a long, erect bristle at base below and three blunt bristles at tip; second joint with three long hairs near middle and third joint with three long hairs near tip; middle tarsi (Fig. 9) yellow with fifth joint black and fringed on both sides with long black hairs; the middle tarsi are straight and rather stout, none of the joints being at all attenuated; hind tarsi wholly black; joints of fore tarsi as 38–12–12–8–10; of middle pair as 37–21–18–9–11; of posterior pair as 29–38–28–20–17. Calypters pale yellow with black cilia; knobs of halteres dark yellow, stem brown.

Wings gray; third vein nearly straight; last section of fourth vein bent near middle, this bend broadly rounded; beyond the bend it is concave posteriorly; last section of fifth vein curved, its length as 20, cross-vein as 19; hind margin of wing slightly notched at tip of fifth vein.

TYPE.—Male, without locality label, but among South American species which were mostly from Brazil; S. W. Williston collection.

It comes near *stylatus* Becker, differing in having the last joint of middle tarsi fringed with long black hair and the hypopygium wholly black. Two more forms described by the author, taken by Mr. and Mrs. Edwards of the British Museum, have the last joint of middle tarsi fringed with black hairs; *brevimanus* has the bristles of the hind tibiæ inserted in black spots; *edwardsi* has the basal half of fore coxæ blackened and middle tarsi black from tip of first joint, also the third and fourth joints of middle tarsi of equal length. In *nigroterminalis* the third joint of middle tarsi is twice as long as fourth.

Paraclius viridus new species

Length, 3.7 mm.

MALE.—Face in the middle narrower than third antennal joint, silvery white; palpi brown; front with white pollen which conceals the green ground color, except when viewed obliquely; antennæ yellow, third joint largely brown, almost twice as long as wide, rounded at tip, arista with long hairs, almost feathered; lateral and inferior orbital cilia white.

Dorsum of thorax and first three abdominal segments shining green, apical segments of abdomen more coppery; the black stripe above root of wing wide, reaching the suture; the silvery-white pollinose spot at the suture not conspicuous; pleura dulled with gray pollen; second and third abdominal segments with large, fourth and fifth with small spots of silvery-white pollen on the sides; hypopygium coppery brown, rather slender with a curved, petiolate segment, which is about one-third as long as hypopygium, outer lamellæ (Fig. 10) yellow, blackened toward the tip, somewhat oval, pointed at tip, with long hairs on one edge, short on the other.

Coxæ, femora, tibiæ, and tarsi yellow, tarsi a little darker at tip, middle coxæ blackened on outer surface; fore coxæ with three long bristles at tip and one above them on outer anterior side; fore tibiæ without a bristle below; middle tibiæ with two bristles below, one near basal third, the other at apical third; hind tibiæ with one bristle below near apical third; femora nearly bare below; joints of fore tarsi as 24–12–8–5–4; middle pair as 38–23–17–10–8; first three joints of posterior pair as 28–38–29. Calypters and halteres yellow, cilia of former black.

Wings dark gray, slightly tinged with brown in front of third vein; third vein nearly straight; last section of fourth vein quite abruptly bent just before its middle, then running nearly straight to wing margin near tip of third vein; last section of fifth vein only a little curved, slightly longer than cross-vein.

TYPE.—Male, taken by F. J. Dyer, December 19, 1916, at La Ceiba, Honduras.

The rather large third antennal joint, slender, petiolate hypopygium with its yellow, pointed lamellæ, separate this from related forms; the long hairs on the arista would almost put this in the genus *Sarcionus*. It differs from *robustus* Becker in having the antennæ yellow with most of third joint brown and the front wholly opaque with white pollen. *Robustus* has the antenna reddish with second and third joints black above and front white pollinose on upper two-thirds.

Pelastoneurus brasiliensis, new species

Length, 4–4.2 mm.

MALE.—Face wide, its suture near the middle, upper half concave with a median depressed line and oblique ridges extending outward and upward from the middle lines lower half bulging, wholly opaque with white or grayish-white pollen, on upper half the green ground color usually shows through the thin pollen, but sometimes the face is wholly opaque with pollen; palpi yellow, black at base, white pollinose; proboscis, brown; front opaque with brown pollen or nearly so; antennæ yellow, third joint blackened at tip; about as long as wide; lateral and inferior orbital cilia white.

Dorsum of thorax shining blackish with slight green or purple reflections and thick brown pollen when seen obliquely; the black stripe above root of wing quite distinct; seen from above there is a large spot of white pollen at the suture; pleura black with white pollen. Abdomen green with coppery reflections and white pollen, last segment wholly white pollinose; hypopygium black, large, not petiolate, its lamellæ (Fig. 11) black, a little yellow at base, somewhat fusiform, obtusely pointed at tip, with pale hairs.

Fore coxæ wholly yellow with a few small yellow hairs on outer edge, nearly bare in front and with several black bristles at tip; middle and hind coxæ reddish brown at base, brown apically; femora, tibiæ and tarsi yellow, tarsi a little darkened at tip; fore tibiæ with one long bristle above near middle, none below; middle tibiæ with two large bristles on lower anterior edge, near first and second thirds; hind tibiæ with one large bristle below near apical third; joints of fore tarsi about as 27–14–10–8–10; of middle pair as 39–24–18–14–11; hind pair as 30–40–28–18–14. Calypters, their cilia and the halteres yellow; there are several black hairs among the cilia.

Wings grayish; third vein bent back a little toward tip; last section of fourth vein bent before its middle, this bend broadly rounded; beyond this bend it is nearly straight, ending near tip of third vein; last section of fifth vein curved, its length as 27, cross-vein as 19; hind margin of wing a little notched at tip of fifth vein.

FEMALE.—Face as in the male, except that the pollen is more brown in the middle; color is a brighter and purer green; fore coxæ with numerous and conspicuous black hairs; hind tarsi with conspicuous spines below, their joints as 30–36–28–18–15; cilia of calypters black.

TYPES.—Holotype, male, allotype, female, and thirty-two paratypes taken at Corumba, Brazil, in May; one male and two females at Piedra, Brazil; and one female at Conceição, Paraguay.

This is near *flavipes* Schiner, also described from Brazil, but in that form the hypopygial lamellæ are small and there are other points of difference.

Pelastoneurus plumicauda, new species

Length, 4 mm.

MALE.—Face wide, covered with white pollen, which appears brown in certain lights on upper half, its suture above the middle, lower part bulging; palpi yellow with black hair; proboscis brown; front opaque with brownish-gray pollen; antennæ yellow, third joint rounded, as long as wide, arista feathered with about five long rays on each side; occiput shining green with a little white pollen; lateral and inferior orbital cilia white.

Thorax green; acrostical bristles rather small, in two rows, inserted in a shining green stripe on each side of which is a slightly wider coppery stripe; dorsum dulled with gray pollen, pleura with white pollen. Abdomen green, sides and most of last segment white pollinose; hypopygium (Fig. 12) black, long and rather slender, its lamellæ white, narrowly black on apical margin and yellow at base; at tip the lamellæ have a long black filament, fringed with long hairs; inner appendages small, black with three or four long hairs at tip.

Fore coxæ wholly yellow with small black hairs and two large bristles near tip; middle and hind coxæ black; fore and middle femora and tibiæ and fore tarsi yellow, posterior legs missing in type, middle tarsi yellow at base, becoming brown at tip; fore and middle femora with delicate, short, yellow hairs below; middle tibiæ with two bristles on lower anterior surface; joints of fore tarsi as 26–14–12–7–10; of middle ones as 47–21–19–12–13. Calypters and halteres yellow, cilia of former black.

Wings grayish; third vein straight; last section of fourth vein a little bent at basal third, then running straight to wing margin, ending nearer tip of third vein than apex of wing; last section of fifth vein curved, its length as 22, cross-vein as 18; hind margin of wing notched at tip of fifth vein.

FEMALE.—Like the male in color, form of face, antennæ and wings; hind femora and tibiæ yellow, their tarsi yellow at base, brown from tip of first joint, their joints as 33–42–30–17–13.

TYPES.—Holotype, male, allotype, female, taken at Conceição, Paraguay; S. W. Williston collection.

P. digitulus Becker comes nearest this species, but has the hypopygial lamellæ sordid yellow with a thread-like inner appendage, while *plumicauda* has the lamellæ large, white, with a very long, ribbon-like, brown appendage, extending from the upper corner, which is fringed with long hairs.

Pelastoneurus ochreifacies, new species

Length, 4.5 mm.

MALE.—Face wide, its suture near the middle; lower part bulging, upper part concave with a depressed median line and with oblique ridges extending upward and outward from median line, its ochre-yellow pollen thin, the green ground color showing through, facial orbits narrowly gray, lower part opaque with ochre-yellow pollen, widely gray pollinose on the sides and lower edge; front opaque with brown pollen; palpi black at base, yellow on the edge, white pollinose with black hairs; antennæ yellow, third joint mostly brown, as long as wide; arista feathered with about ten long hairs on each side; lateral and inferior orbital cilia white.

Dorsum of thorax shining, greenish black with brown pollen; the black stripe above root of wing and silvery white pollinose spot at suture present, rather large, but not very sharply defined; pleura white pollinose. Abdomen blackish with coppery reflections, spots on sides of segments and whole of last segment white pollinose; hypopygium (Fig. 13) black, large and sessile, its lamellæ petiolate, with apical part large and black with yellow hairs, at base is a small yellow appendage.

Fore coxæ yellow, a little darker at base with a few small black hairs on anterior surface and one large bristle at tip; femora, tibiæ and tarsi yellow, tarsi a little darkened towards tip; fore tibiæ without a bristle below, middle ones with two large bristles on lower anterior edge; posterior tibiæ with one bristle below; joints of fore tarsi as 27–15–13–8–8; middle ones as 40–25–20–13–13; first two joints of hind tarsi as 37–43. Calypters and halteres yellow, cilia of former partly yellow and partly black.

Wings grayish, third vein straight; last section of fourth vein bent before its middle, the bend broadly rounded; beyond the bend running nearly straight to wing margin, ending close to tip of third vein; last section of fifth vein much curved, its length as 24, cross-vein as 17; hind margin of wing notched at tip of fifth vein.

FEMALE.—Face with ground color showing through the pollen on upper half, suture above the middle, lower part yellowish-brown pollinose with white pollen along the orbits; fore coxæ with four bristles at tip; all tibiæ with bristles as in the male; bend in last section of fourth vein a little before the middle as in the male.

TYPES.—Holotype, male, allotype, female, taken at Corumba, Brazil, in May; S. W. Williston collection.

This is much like *brasiliensis*, new species, differing in the color of face, in having the third vein of wing straight, and in having the apical part of hypopygial lamellæ wider and broadly rounded at tip; it differs from *flavipes* Schiner, in that its lamellæ are much larger, although they are small in *flavipes*.

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EXPLORATIONS, RESEARCHES AND PUBLICATIONS OF PIERRE TEILHARD DE CHARDIN, 1911–1931

WITH MAP AND LEGEND SHOWING CHIEF FOSSIL COLLECTING AREAS OF CHINA, 1885–1931

BY HENRY FAIRFIELD OSBORN

In recent years the Department of Vertebrate Palæontology of the American Museum has enjoyed the cooperation of Pierre Teilhard de Chardin, especially in the Eocene fauna of France from the Paleocene stage up to the close of the Phosphorites or Lower Oligocene time, also through explorations and researches first reported to the Musée National d'Histoire Naturelle of Paris in the year 1920. The American Museum Central Asiatic Expedition of the summer of 1930 was fortunate in obtaining the cooperation of Teilhard in the field. On February 10, 1931, he addressed the Osborn Research Club and summarized the results of his explorations in China, accompanying his address by the map which is reproduced herewith. The present article is prepared as a brief outline of the principal observations made by Teilhard in the Eocene of France and Belgium and as a summary of the observations made in China, concluding with an abstract of the address of February 10 above mentioned, a bibliography of his writings now contained in the Osborn Library of the American Museum, and a map showing twenty-three of the chief fossil collecting areas of China prepared by Teilhard for the present publication.

OLIGOCENE TO MIDDLE EOCENE

Under the direction of Marcellin Boule, now the ranking vertebrate palæontologist of France, Teilhard began his studies in 1911 with a synthetic review of the creodonts and true carnivores, of the PHOSPHORITES DU QUERCY, the famous fissure horizon of Eocene to Oligocene age, tracing their phylogeny (1915, p. 64) in polyphyletic lines through the families of adaptive creodonts, of viverrines, of mustellines. Here occur the genera *Miacis*, ancestral to the dogs, *Viverravus*, *Cynodon* and *Cynodictis*. Teilhard concludes that the PHOSPHORITES fauna represents (1) the close of Eocene time, embracing *Miacis*, *Viverravus* and

Cynodictis; (2) also Lower Oligocene time in which are added primitive cynodonts and stenoplesictids; (3) finally, Upper Oligocene of AQUITANIAN, in which are added *Amphicyon, Cephalogale, Plesictis,* etc., almost exact equivalents of the JOHN DAY American fauna of canids and mustelids. In brief, the carnivores of QUERCY (op. cit., p. 87), taken altogether, completely fill the gap between the Middle Eocene LUTETIEN, and the Upper Oligocene AQUITANIAN.

Teilhard in 1911 was disposed theoretically to trace the wolf, *Canis vulpes,* back to some of the cynodictids of QUERCY; the bear, back to *Cephalogale;* the raccoon (possibly) back to *Phlaocyon* and *Pachycynodon;* the marten back to *Plesictis.*

EXPLORATIONS IN THE LOWER EOCENE AND PALEOCENE

Between 1916 and 1921, Teilhard devoted himself partly to the lemuroids of QUERCY and partly to Paleocene mammals. Of the former he remarked that the smaller lemuroids, *Microchœrus, Necrolemur* and *Pronycticebus,* were rare and revealed themselves slowly, while the larger *Adapis* was abundant. Stehlin (1915), just previously, had coordinated the work of Filhol and Rütimeyer by comparing the fossil primates of QUERCY with those of other fissure deposits—EGERKINGEN and LISSIEU—describing three new genera (*Anchomomys, Nannopithex, Pseudoloris*). It remained for Teilhard to establish a systematic relation of the *Pseudoloris* of Stehlin with the American Eocene *Anaptomorphus* of Cope, as transitional to the modern tarsiids (1916.1, pp. 9–13).

Most fortunate for vertebrate palæontology was the entry of Teilhard into the Paleocene fauna of France as revealed in the basin of Paris at Rheims, a fauna scarce at the time and little understood. In this (1916.2) as in previous memoirs, Osborn's nomenclature of the teeth was adopted in full. This memoir is a masterpiece, revealing (p. 100) new and previously undemonstrated relationships with America of multituberculates, arctocyonids, oxyclænids, meniscotheres, previously regarded as confined to the WASATCH or SUESSONIAN of America; added as a new element is the close relationship of *Nothodectes* of CERNAY near Rheims with the corresponding form of the TIFFANY beds of New Mexico preceding the WASATCH. From the morphological, zoögeographical and phylogenetic standpoints, this memoir marks a great step forward. Agreeing with Osborn, Teilhard regards most of the true Paleocene mammals as not ancestral to more modern *Ceneutheria,* with the exception of the "*Pleuraspidotherides,*" which Teilhard regards as possibly related to the modern *Hyrax* of Africa.

In 1920 (pp. 1161–1162) appeared the geologic classification of the Lower Eocene animals into (1) CERNAYSIAN, with *Nothodectes* and lower fauna described by Lemoine; (2) SPARNACIAN, with *Coryphodon-Hyracotherium* fauna equivalent to our lower WASATCH; (3) CUISIAN, somewhat more recent than the above; (4) the faunistic separation period between western Europe and America, extending to the summit of the Eocene (See Osborn: "Age of Mammals," 1910, p. 138).

In 1921, Teilhard announced the discovery of a condylarth in the Paleocene of Belgium, seemingly related to the problematic *Hyopsodus* of the Bridger, which W. D. Matthew in 1899 indefinitely placed with the Primates.

EXPLORATIONS IN CHINA

(See map and legends)

From the Licent expedition of 1920, the Paris Museum received a collection of fossil mammals from northeast Kansu of the *terres rouges Hipparion* zone—giraffes, hyenas, mustelids—which Teilhard examined and reported as of PONTIAN age, with analogies to Persia and Europe (but not to India) and with, at the same time, characters peculiar to the province of China; this is the fauna of King Yang Fou (1922.1, pp. 979–982).

The next step in Teilhard's career occurred in the summer of 1923, when the French Ministry of Education and the Musée National d'Histoire Naturelle sent him, with Father E. Licent, for a geological expedition in the region of the Ordos, along the Great Wall of China. Here he did his first geologic and stratigraphic work in China, including the recognition in northwestern Ordos of a series of Oligocene beds containing *Baluchitherium* (HSANDA GOL formation of the Central Asiatic Expedition). This Ordos region presents at least three great recent stages: (1) typical Pliocene clays, (2) Lower Pleistocene high gravel terraces, and (3) a comparatively Recent phase (true Loess) falling distinctly in the Age of Man. Dramatic and important was the discovery of a true palæolithic deposit in the southeast corner of the Ordos, with most welcome knowledge of palæolithic (Mousterian) stratigraphic and palæontologic conditions, giving us at the hands of Teilhard and Licent (1924.5) one of the most important discoveries of modern times. Geologic observations followed in rapid succession (1924.6) in northern Chihli and eastern Mongolia, and Teilhard ably qualified himself as a member of the National Geological Survey of China.

In 1925 appeared the first contribution of an expedition (1924) in the eastern Gobi volcanic area, followed by return to observations in the Paleocene of Belgium (1925.2, p. 48) which yielded, from Orsmael and Erquelinnes, the Lower Eocene, a rich series of mammals referred to *Omomys, Plesiadapis, Heterohyus, Ectocion* (near *Phenacodus*) and *Palæonictis*, thus enriching the previous knowledge of the Orsmael and Erquelinnes.

Teilhard now launched into the Neolithic of China (1925.3), following the steps of J. G. Andersson, and began to take up the problem of the invasion of America from northern Asia, returning the same year (1925.4, pp. 201–234) to the more serious exploration of the Palæolithic of China based on discoveries of flints akin to those subsequently found by N. C. Nelson of the Central Asiatic Expedition in the Gobi. In this Palæolithic work, Teilhard enjoyed the cooperation of the Abbé Breuil. The fauna is that of the glacial period of all of northern Europe, chiefly of the steppe type but embracing also the '*Elephas* [*Palæoloxodon*] *namadicus*' (Idem, p. 223) [possibly *Parelephas*? sp. Osborn] as well as the giant ostrich *Struthiolithus* of Eastman, mingled with names of more modern types resembling modern gazelles and the steppe ass (*Equus hemionus*), rightly correlating the fauna of the upper "yellow' earths" of Asia with the loess of Europe, especially with the *ergeron* of France of the time of Mousterian or early Aurignacian flint culture.

In 1926 appeared a geologic study (1926.4) of the region of DALAI NOR, as a result of the 1924 journey of Licent and Teilhard, enriching the fauna and extension of the RED PONTAIN clays (p. 52) and establishing above this Lower Pliocene series a new Lower or Middle formation (possibly of the same age as the TUNG GUR formation subsequently discovered in 1928 by the Central Asiatic Expedition). The work of 1926 also included a treatise on the older rocks and eruptions of eastern Mongolia.

During 1926 announcement was made by Licent, Teilhard and Davidson Black of a human upper incisor, strongly fossilized, found with *Struthiolithus;* this was described and figured (1927.3) as the "Ordos tooth," truly fossil, and compared by Hrdlicka with the tooth of La Quina age in France. Cooperation with Licent yields the late Pliocene fauna of SANGKAN Ho (1927.2), rather modern, with the exception of some more ancient forms such as *Machairodus, Hipparion, Chalicotherium* and large extinct deer. The PONTIAN, SANMERIAN (Basal Pleistocene) and LOESS prove more and more to constitute the three important geological stages of north China, in Upper Tertiary and Quaternary times.

In 1927 Teilhard and Licent analyzed, for the National Geological Survey of China, the superior Quaternary and Tertiary of Honan and southern Shansi, the first distinct step in the recognition of a thick series intermediate between the lower Pliocene PONTIAN and the late Pleistocene of northern China. During this year also, Teilhard contributed to *Palæobiologica* (1928.1) a philosphical generalization on the extreme slowness of the evolution of mammals over a long period of time on the continent of Asia, derived from comparison of certain genera like the Musk Deer (*Moschus*), the gazelles, the hyenas, and the rodents *Siphneus* and *Lagomys*. The repeated alternation of sands, red earths and loess points to climatic rhythms in central and eastern Asia of stocks of mammals peculiarly Asiatic.

In April, 1928, appeared a second report (1928.3, pp. 960–961) on post-Palæozoic eruptions of western China, emphasizing the distinction of two fundamental phases in the Mesozoic intrusives of eastern China (a basic followed by an acid phase). This was followed by an elaborate memoir, "Le Paléolithique de la Chine" (1928.4), in collaboration with Boule, Breuil and Licent, in the *Archives de l'Institut de Paléontologie Humaine* which will constitute the foundation of all future human palæontology in China and Mongolia, based upon close analysis of all the Pleistocene of China known up to 1928, with flint implements closely analyzed by Breuil and with the geology and mammalian fauna treated in a masterly way by Teilhard, the mammals closely approaching those of the Middle or Upper Pleistocene of Europe.

The year 1929 brought forth a detailed report (1929.1) on the geology of the now famous CHOU KOU TIEN (**16A**) fissure deposit which yielded the Peking man, *Sinanthropus*, regarded by the authors, Teilhard and Young, as Lower Pleistocene (1929.1, pp. 173–202)—a determination dependent upon the precise subspecific stage of the '*Elephas namadicus* ref.' Of great interest is the geologic age of *Sinanthropus pekinensis* from the cave of CHOU KOU TIEN (**16A**), thirty-five miles southwest of Peking. Teilhard gives us (1931.1) the first clear critical light on this important subject, dating the Peking man as undoubtedly early Pleistocene, quite as ancient as the Gibraltar man and much more ancient than the Neanderthal man. CHOU KOU TIEN (**16A**) was a true cave, although filled by a succession of deposits and consequently displaying different stratigraphic levels; it is certainly older than the widespread Upper Pleistocene 'yellow loess' of China characterized by the woolly rhinoceros (*R. tichorhinus*), the urus (*Bos primigenius*), the stag (*C. elaphus*), the spotted hyena (*H. crocuta*), etc., with occa siona

Palæolithic quartzite implements of Mousterian and Aurignacian type.

The Chou Kou Tien (**16A**) fossil deposits positively belong to the early Pleistocene containing the giant rhinoceros (*Rhinoceros* cf. *sinensis*), the primitive hyena (*H. sinensis*), the saber-toothed hyena (*H. machairodus*), the fossil dog (*Canis sinensis*), and the fossil horse (*E. sanmeniensis*), species which closely correspond with similar forms in the Nihowan deposits, but Chou Kou Tien (**16A**) lacks certain of the distinctly Upper Pliocene fossils found in Nihowan, such as *Hipparion sinense*, chalicotherid (*Circotherium*), etc. In geologic character the period is clearly distinguished from Upper Pleistocene 'yellow loess,' namely, a series of sands, clays, and 'reddish loess,' a formation which begins at the end of the Pliocene and extends into the Lower Pleistocene.

Teilhard's latest contributions are two analyses of the thick intermediate 'reddish clays' or older loess, relatively unfossiliferous, which lie between the well-known Lower Pliocene Pontian or *Hipparion* stage and the late Pleistocene *terres jaunes* or yellow loess (the stage of the woolly mammoth and rhinoceros).

First subdividing the Pliocene by the evolution of burrowing rodents chiefly of the genus *Siphneus* (1930.1), he described (1930.2, pp. 3–134) a very rich and important fauna collected in 1924–6 by Licent and himself in the basin of Nihowan in the Sangkan Ho valley northwest of Peking. This newly known fauna is of an uppermost Pliocene age, and its discovery is the culmination of fifteen years of exploration, affording a solid base for the oldest prehistory in China. In this last memoir (1930.2) were summed up not only the previous geologic analyses of the three great east Asiatic levels, Pontian, Reddish Clays, Loess, but also an important new fauna, including '*Elephas* [*Palæoloxodon*] *namadicus*,' chalicotheres, both *Hipparion* and *Equus*, a giant camel (*Paracamelus gigas*), four types of cervids, a variety of bovids including a primitive *Bison*, a mingling of modern and ancient carnivores, including *Machairodus*. This fluvio-lacustrine, Plio-Pleistocene fauna of Nihowan, considered parallel with that of Sénèze, France, described by Depéret, is not absolutely determinable but appears to belong to the very top of the Pliocene age. It appears that the lake-border and molluscan fauna descended over the Plio-Pleistocene lakes of the Gobi to the lower lakes of the Sangkan Ho, and some of the Mollusca can be traced even in degenerate forms to the actual border of the Pechili Gulf.

A new area was also described (1930.1) for the Palæolithic in China (western Shansi and northern Shensi), strictly connected with the distribution of quartzite material.

SUMMARY OF THE PALÆONTOLOGIC AND CLIMATIC SUCCESSION IN CHINA

In the report of his informal address before the Osborn Research Club on February 10 (*Natural History*, XXXI, No. 3, May-June, 1931, pp. 338–339), Teilhard's more recent observations were summarized as follows:

A good deal of work had been done in a locality in the northwestern part of Shansi Province near the Yellow River where there is a limited area of Upper Pliocene and Lower Pleistocene exposures. Teilhard described a hard floor of Palæozoic sediments, covered by a thick series (reaching 300 meters in depth) of Quaternary deposits; these lowest beds are much more complex than those of simple loess origin. Directly overlying the Palæozoic beds occurs a red clay of Upper Pliocene age which, for convenience, is called Member 3 of the later series. A few fossils are found in it, including *Hipparion* and *Aceratherium*.

The next higher series, Member 2, consists of reddish clays, rich in limestone nodules. These concretions are found in pocket layers, sometimes in gravels, covered by loess or reddish clay; fossils are not very common in these reddish clays except in the concretions which are full of rodent skulls and skeletons. These are mostly of the mammal genus *Siphneus* represented by several good species, and very similar to a mole-like rodent now common in that region. A few specimens of horse, wild cattle, and deer were secured, but they were scarce in this locality. Teilhard considers this Member 2 series an older, sometimes banded, loess, of either Upper Pliocene or Lower Pleistocene age.

The uppermost layers of loess, Member 1, are of Lower Pleistocene age and contain more recent species of *Rhinoceros*, *Bos*, *Equus*, etc. The loess deposits of Member 1 and probably also of the older Member 2 were apparently formed because prevalent winds from the northwest drifted the dust from the Mongolian deserts over this section of China.

Another basin appearing to be the same as the Member 2 beds was discovered, where fossils of horse, bison, water buffalo, deer and sheep were abundant, and a study of the fauna seems to link it with Upper Pliocene times.

The Tung Gur beds near Iren Dabasu, where the Central Asiatic Expedition has collected, are also supposed to be the same age as these reddish clays of Member 2. They are extraordinarily similar, lithologically and in the vertebrate and invertebrate faunas, to the beds of an Upper Pliocene lake which Teilhard has described in his most recent paper "Les Mammifères Fossiles de Nihowan (Chine)." He supposes that in the Upper Pliocene there was a series of lakes in the eastern Gobi which retreated southward with advancing desiccation.

In southern China, Teilhard believes the Upper Pliocene is represented mostly by cave deposits, and in northern China by gravels. The Yellow River has cut through in various places so that the sections are clearly shown, and he thinks similar sections can be found both to the north and south along the river. He also made mention of a Palæolithic flint which was found, covered by loess, near the bottom of the Member 2 series of reddish clays, about fifty meters above the river level, where it had apparently been washed down from a higher level.

ABBÉ BREUIL AND PIERRE TEILHARD DE CHARDIN (right), January, 1931

BIBLIOGRAPHY OF PIERRE TEILHARD DE CHARDIN

From the works now in the Osborn Library of the American Museum

1915.1 Les Carnassiers des Phosphorites du Quercy. *Annales de Paléontologie*—1914–1915, IX.

1916.1 Sur Quelques Primates des Phosphorites du Quercy. *Annales de Paléontologie*—1916–1921, X.

2 Les Mammifères de l'Éocène Inférieur Français et Leurs Gisements. *Ibid.*, X and XI.

1920.1 Sur la Succession des Faunes de Mammifères dans l'Éocène Inférieur Européen. *Compte Rendu Acad. Sci.* (Paris), December 6, 1930.

1921.1 Fossil Man. (Review of Boule: *Les Hommes Fossiles*). *The Living Age,* May 14, 1921, pp. 415–419.

2 Note sur la Présence dans le Tertiaire Inférieur de Belgique d'un *Condylarthré* Appartenant au Groupe des *Hyopsodus.* (With Charles Fraipont.) *Bull. Classe des Sciences,* Acad. R. de Belgique, June 4, 1921, No. 6, pp. 357–360.

1922.1 Sur une Faune de Mammifères Pontiens Provenant de la Chine Septentrionale. *Compte Rendu Acad. Sci.* (Paris), November 20, 1922.

1924.1 Les Gisements de Mammifères Paléocènes de la Belgique. (With L. Dollo.) *Quart. Journ. Geol. Soc. London,* LXXX, Pt. 1, pp. 12–16.

2 Observations Géologiques sur la Bordure Occidentale et Méridionale de l'Ordos. (With E. Licent.) *Bull. Soc. Géol. France,* XXIV, pp. 49–91.

3 Observations Complémentaires sur la Géologie de l'Ordos. (With E. Licent.) *Ibid.,* pp. 462–464.

4 On the Geology of the Northern, Western and Southern Borders of the Ordos, China. (With E. Licent.) *Bull. Geol. Soc. China,* III, No. 1, pp. 37–44.

5 On the Discovery of a Palæolithic Industry in Northern China. (With E. Licent.) *Ibid.,* pp. 45–50.

6 Note sur la Structure des Montagnes à l'Ouest de Linn Ming Kwan (Chihli méridional). *Ibid.,* Nos. 3–4, pp. 393–397.

7 Geology of Northern Chihli and Eastern Mongolia. *Ibid.,* pp. 399–407.

1925.1 Le Massif Volcanique du Dalai-nor (Gobi Oriental). *Bull. Volcanologique,* Nos. 3–4; pp. 1–9.

2 Observations Nouvelles sur les Mammifères du Tertiaire Inférieur de Belgique. *Bull. Classe des Sciences,* Acad. R. Belgique, February 7, 1925, No. 3, pp. 48–50.

3 Note sur Deux Instruments Agricoles du Néolithique de Chine. (With E. Licent.) *L'Anthropologie,* XXXV, pp. 63–74.

4 Le Paléolithique de la Chine. (With E. Licent.) *Ibid.,* pp. 201–234.

1926.1 Sur Quelques Mammifères Nouveaux du Tertiaire de la Belgique. *Bull. Classe des Sciences,* Acad. R. Belgique, April 10, 1926, Nos. 4–5, pp. 210–215.

2 Palæontological Notes. *Bull. Geol. Soc. China,* V, No. 1, pp. 57–59.

3 Le Néolithique de la Chine. *L'Anthropol.,* XXXVI, pp. 117–124.

4 Étude Géologique sur la Région du Dalai-Noor. *Mémoires de la Société Géologique de France,* N. S., III, Memoir 7.

1927.1 How and Where to Search the Oldest Man in China. *Bull. Geol. Soc. China,* V, Nos. 3–4, pp. 201–206.

2 Geological Study of the Deposits of the Sangkanho Basin. (With G. B. Barbour and E. Licent.) *Ibid.,* Nos. 3–4, pp. 263–278.

3 On a Presumably Pleistocene Human Tooth from the Sjara-Osso-Gol (Southeastern Ordos) Deposits. (With E. Licent and Davidson Black.) *Ibid,* Nos. 3–4, pp. 285–290.

4 On the Recent Marine Beds, and the Underlying Freshwater Deposits, in Tientsin. (With E. Licent.) *Bull. Geol. Soc.* China, VI, No. 2, pp. 127–128.

5 Observations sur les Formations Quaternaires et Tertiaires Supérieures du Honan Septentrional et du Chansi Méridional. (With E. Licent.) *Ibid.*, pp. 129–148.

6 Les Mammifères de l'Éocène Inférieur de la Belgique. *Mémoires du Musée Royal d'Histoire Naturelle de Belgique*, Mémoire XXXVI.

1928.1 Observations sur la Lenteur d'Évolution des Faunes de Mammifères Continentales. *Paléobiologica*, I, pp. 55–60.

2 Les Couches de Passage entre le Tertiaire et le Quaternaire, en Chine Septentrionale. *Compte Rendu Sommaire, Soc. Géol. France*, January 23, 1928, pp. 12–14.

3 La Nature et la Succession des Éruptions Postpaléozoiques en Chine Septentrionale. *Compte Rendu Acad. Sci.* (Paris), April 12, 1928, pp. 960–961.

4 La Paléolithique de la Chine. (With M. Boule, H. Breuil and E. Licent.) *Archives Inst. Pal. Humaine*, Mémoire IV, July, 1928.

5 Note Complémentaire sur la Faune de Mammifères du Tertiaire Inférieur d'Orsmael. *Bull. Classe des Sciences*, Acad. R. Belgique, August 4, 1928, Nos. 8–9, pp. 471–474.

1929.1 Preliminary Report on the Chou Kou Tien Fossiliferous Deposit. (With C. C. Young.) *Bull. Geol. Soc. China*, VIII, No. 3, pp. 173–202.

1930.1 Preliminary Observations on the Pre-Loessic and Post-Pontian Formations in Western Shansi and Northern Shensi. (With C. C. Young.) *Mem. Geol. Survey of China*, Series A, Number 8.

2 Les Mammifères Fossiles de Nihowan (Chine). (With J. Piveteau.) *Annales de Paléontologie*, 1930–, XIX.

3 Geological Observations in Northern Manchuria and Barga (Hailar). (With E. Licent.) *Bull. Geol. Soc. China*, IX, No. 1, pp. 23–35.

4 Le Phénomène Humain. *Revue des Questions scientifiques*, November, 1930, pp. 1–19.

1931.1 Le "Sinanthropus" de Péking, État Actuel de nos Connaissances sur le Fossile et son Gisement. *L'Anthropologie*, XLI, Nos. 1–2, pp. 1–11.

HISTORY OF FOSSIL COLLECTING IN CHINA, 1885-1931

All the early fossil collections in China came from Chinese apothecary shops or from wholesale dealers in medicines. The Szechwan deposits (16) probably yielded the original materials to Ernst Koken ("Ueber Fossile Saügethiere aus China," 1885), to Richard Owen ("On fossil remains of Mammals found in China," 1891), and to Hikoshichiro Matsumoto ("On Some Fossil Mammals from Sze-chuan, China," 1915). The Max Schlosser Collections, described in his great memoir, "Die fossilen Saügethiere Chinas," 1903, were assembled or purchased from the apothecary shops of many parts of China by Dr. K. A. Haberer.

Undoubtedly many of these specimens, probably the great majority of those from North China, came from the *Hipparion* fauna locality

(**12**), in northwestern Shansi on the Yellow River. Quarrying for "Dragon bones" for medicinal purposes has been carried on in this area for a long time. Otto Zdansky, under the direction of Dr. J. G. Andersson, visited this locality (**12**), made a survey and has published a report ("Fundorte der Hipparion-Fauna um Pao-Te-Hsien in N. W. Shansi," 1923) upon it. Previous to Zdansky's visit, Andersson had obtained large collections from this locality through the agency of his native Chinese assistant.

The chief Jesuit Mission localities are situated around the borders of the Ordos (**8**, **9**, **18**, **19**, **21**) and in the Nihowan Basin, northwest of Peking (**14**). Licent made a general survey of this country, and on discovering the richness of the fossil deposits sent for a trained geologist and palæontologist from France. Teilhard came out to join Licent in 1923, and most of the work which Teilhard carried on was done in co-operation with Licent, first around the Ordos region, later in eastern Mongolia (**1** and **13**) and in western Manchuria (**17**); their work also included locality **14**, northwest of Peking, the important Nihowan fauna. Subsequently Teilhard became associated with the National Geological Survey of China and made an extended journey into northwestern China, visiting localities **10**, **11**, **15** and **20** for a general survey; he was accompanied by Chung-Chien Young, the Chinese vertebrate palæontologist of the Survey.

TWENTY-THREE OF THE CHIEF FOSSIL COLLECTING AREAS OF CHINA, 1885–1931, AS INDICATED BY TEILHARD, FEBRUARY, 1931

1. CARBONIFEROUS. Chahar. Fusuline limestone.
2. LOWER CRETACEOUS. Jehol. Insects, Lycoptera, etc.
3. LOWER CRETACEOUS. Shengking-Jehol border. Insects, Lycoptera, etc.
4. CRETACEOUS. Fossiliferous areas of Shantung. Mengyin Hsien and Lai Yang Hsien yielding sauropod dinosaurs: *Helopus zdanskyi* and *Tanius sinensis.*

4A. EOCENE. Shantung, Mengyin Hsien and Hsin T'ai Hsien. Mammal-bearing beds explored by Zdansky.

5. UPPER EOCENE. Southern Shansi, Yüan Chü Hsien on Yellow River; beds extend across Yellow River into northern Honan. Fossiliferous clays and gravels. Molluscan and small mammalian fauna including amynodont rhinoceroses and lemuroids. Explored by Zdansky.
6. UPPER EOCENE. Southern Honan, Mien Chih Hsien. Irdin Manha Fauna. Small mammalian fauna, described by Zdansky.
7. UPPER EOCENE. Chihli, Chang Sin Tien, southwest of Peking. Fossiliferous gravels.
8. OLIGOCENE. Northwest Ordos Basin. *Baluchitherium* zone. Contains Oligocene Hsanda Gol fauna. Described and explored by Licent and Teilhard.
9. OLIGOCENE. Kansu-Ordos border. *Baluchitherium* sands, equivalent to 8. Explored and described by Licent and Teilhard.
10. PLIOCENE–PONTIAN FAUNA. Eastern Kansu. Palæolithic cultures in the overlying loess. Excavated by Licent.
11. PLIOCENE–PONTIAN FAUNA. North Shensi, You Fang T'eon.
12. PLIOCENE–PONTIAN FAUNA. Northwest Shansi, Pao Te area. Fossiliferous reddish clays. The most important of the *Hipparion* fauna localities. First explored by Andersson and later by Zdansky; from this locality a great amount of material had come through the Chinese excavations for "Dragon bones"; probably also a source of much of Schlosser's apothecary shop material.

13. PLIOCENE–PONTIAN FAUNA and later. Chahar, eastern Mongolia, Chitong Gol Basin. White Pliocene beds, which may be equivalent to Tung Gur beds of Mongolia, overlying fossiliferous Pontian.

14. UPPERMOST PLIOCENE AND EARLY PLEISTOCENE. Chihli, Nihowan Basin, northwest of Peking. Late Pliocene, Nihowan fauna. Area worked by Licent and Teilhard, yielding highly important Nihowan fauna.

15. PLIOCENE, PONTIAN and later. Central Kansu, Lanchow Basin.

16. LOWER PLEISTOCENE. Eastern Szechwan, Yen Ching Kou. It is probable but not certain that the type materials of Ernst Koken (1885), of Richard Owen (1891) and of Hikoshichiro Matsumoto (1915) came from these cave deposits of eastern Szechwan, also probably some of that described by Schlosser. Excavations by natives for "Dragon bones" have been carried on for at least two generations in this area. Cave deposits explored by Granger in winters of 1921–1922, 1922–1923, 1925–1926. A rich fauna containing *Stegodon*, *Megatapirus*, *Aeluropus*, etc.

16A. LOWER PLEISTOCENE. Chihli, Chou Kou Tien, thirty-five miles southwest of Peking. *Sinanthropus pekinensis* and large mammalian fauna. Discovered by J. G. Andersson, August, 1921; explored first by Andersson and Zdansky, and later by Bohlin and others under the auspices of the National Geological Survey of China.

17. UPPER PLEISTOCENE. Southeast of Chancow, Manchuria. Rich fossiliferous deposits, *Rhinoceros tichorhinus*, bison, *Elephas*.

18. PLEISTOCENE. Southwestern Ordos, Choei Tang Keon, on Yellow River. Loessic Basin, Palæolithic site. One of the areas discovered and explored by Licent and Teilhard.

19. PLEISTOCENE. Southern Ordos, Sjara Osso Gol Basin. Rich mammalian fauna; important Palæolithic site. Discovered and explored by Licent and Teilhard.

20. PLEISTOCENE. Shensi-Shansi border, Yellow River. Gravels bearing Palæolithic cultural remains.

21. PLEISTOCENE. Eastern Ordos. Loess and sub-loessic gravels. Palæolithic quartzite implements. Also one of the Licent and Teilhard localities.

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XIII[1]

A SYSTEMATIC LIST OF THE BIRDS OF RENNELL ISLAND WITH DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES

By Ernst Mayr

The exploration of the bird fauna on Rennell Island has always been considered as one of the outstanding ornithological tasks since C. M. Woodford discovered there in 1906 an endemic genus of the Zosteropidæ. But the inaccessibility of the island and the bad reputation of the inhabitants prevented a thorough exploration for many years, till Mr. H. Hamlin's enterprise and courage finally led to success in an investigation of this isolated island. The results of this collecting trip have far exceeded expectations, and the bird fauna of Rennell Island has turned out to be one of the most interesting in the whole South Sea. With a feeling of great satisfaction I accepted the offer of The American Museum of Natural History to work out this fine collection. My work was greatly facilitated by the kind help and advice I received from my colleagues, Dr. F. M. Chapman, Dr. R. C. Murphy, and Mr. J. T. Zimmer. My special thanks are due to Lord Rothschild, who permitted the loan of valuable specimens from the Tring collection, and to Mr. Arthur Goodson, who supplied me with many notes and measurements from collections in the Tring Museum.

In the arrangement of the families and genera I have departed from the former publications in this series in order to accord with Mr. James L. Peters' forthcoming 'Check List' of the birds of the world, which in turn follows the arrangement proposed by Dr. A. Wetmore.[2] All measurements are in millimeters, weights in grams, and colors according to Ridgway's 'Color Standards.'

Mr. Hannibal Hamlin has increased the value of the collection considerably, by notes on the geography of Rennell Island and the ecology of its bird life.

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[1] Previous papers in this series comprise American Museum Novitates, Nos 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, and 469

[2] Alexander Wetmore, 1930, 'A Systematic Classification for the Birds of the World.' Proc. U. S. Nat. Museum, LXXVI, Art. 24, pp. 1–8.

SYSTEMATIC LIST OF THE BIRDS COLLECTED ON RENNELL ISLAND

1.[1] **Colymbus[2] ruficollis longirostris,** new subspecies

TYPE.—No. 224664, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; September 5, 1928; H. Hamlin.

SUBSPECIFIC CHARACTERS.—Similar to *novæhollandiæ*, but bill larger and longer; chestnut on the sides of the head darker; white on the wing, especially on the secondaries, farther extended.

	WING	BILL	TARSUS
5 ♂	105–111(107.4)	22–24(23.1)	37–42(39.8)
5 ♀	100–104(102)	20–23(21)	37–39(38.4)

RANGE.—Rennell Island (collected Sept. 1928 and May 1930).

It is a remarkable discovery that this subspecies, which is so close to the Australian *novæhollandiæ*, occurs on Rennell Island, and that *tricolor* does not. This fact, and specimens collected by the Whitney Expedition on the New Hebrides make it probable that the species also breeds on New Caledonia. It has been recorded from there several times (Sarasin, 'Die Vögel Neu-Caledoniens,' p. 68), but the specimens were always considered as winter migrants from Australia.

The birds from the New Hebrides are also new.

Colymbus ruficollis leucosternos, new subspecies

TYPE.—No. 215376, Amer. Mus. Nat. Hist.; ♂ ad.; Dolphin Island, New Hebrides Islands; September 7, 1926; R. H. Beck and J. G. Correia.

SUBSPECIFIC CHARACTERS.—Similar to *novæhollandiæ*, but at once distinguishable by its pure white lower breast, lacking the dusky feather centers of *novæhollandiæ;* the wing is more white also; in some specimens the secondaries are almost entirely white, although this character varies to a great extent; bill and tarsus of about the same size as in *novæhollandiæ*.

	WING	BILL	TARSUS
5 ♂	108–113(109.8)	20–22(21.6)	36–39(38.2)
10 ♀	100–106(102.8)	19–21(19.7)	35–37(36.1)

RANGE.—Dolphin Island, New Hebrides (collected Sept. 1926).

The small Dolphin Island (off the northeastern coast of Espiritu Santo Island) is the only place in the New Hebrides where this species has thus far been found.

To make a comparison possible, I will give the measurements of some typical *novæhollandiæ*, which were kindly sent to me from the Tring Museum.

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[1] Species known from Rennell Island are numbered consecutively.

[2] *Colymbus* seems to be the correct name for this genus, although the question has not as yet been settled.

Colymbus ruficollis novæhollandiæ (Stephens)

Podiceps novæhollandiæ Stephens, 1826, in Shaw's 'Gen. Zool.,' XIII, pt. 1, p. 18, Feb.; New South Wales.

Podiceps fluviatilis carteræ Mathews, 1912, Nov. Zool., XVIII (1911), p. 197; Broome Hill, Southwest Australia [type examined].

Podiceps fluviatilis parryi Mathews, idem, p. 197; Parry's Creek, Northwest Australia [type examined].

I measured 6 adult specimens: *parryi* (type), ♀; *carteræ* (type), ♀; Cape York, 1 ♀; Queensland, 1♂; Sydney, 1 (unsexed); Talaut Island, 1 (unsexed) migrant. Wing: 102, 110, 110, 106, 113, 102. Bill: 20, 17+x, 21, 21.5, 21, 19. Tarsus: 36, 36, 38, 38, 40, 34.

The type of *carteræ* has the tip of the bill broken off, which explains the shortness on which Mathews based his description. Otherwise I cannot find any differences between *carteræ*, *parryi*, and the other Australian material, although my material is limited.

2. **Phalacrocorax melanoleucus brevicauda**, new subspecies

Type.—No. 224574, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; September 4, 1928; H. Hamlin.

Subspecific Characters.—Smaller than *melanoleucus*.

	Wing[1]	Tail	Culmen	Tarsus
10♂ ad.,	204–217(211 8)	124–143(132 3)	30–31(30.2)	36–40(38.5)
8 ♀ ad.	194–206(202.4)	116–132(125 9)	30–32(30.8)	35–38(36.6)
4♂ imm.	195–209(202)	120–127(123 9)	30	36–37(36.5)
1 ♀ imm.	195	112	30	35

Range.—Rennell Island (collected Sept. 1928).

Most of the specimens are freshly molted. The juvenal specimens are distinguished by the brownish edges of the feathers (especially on head, scapulars, and wing-coverts) and by the smaller measurements.

Phalacrocorax melanoleucus subspecies

	Wing	Tail	Culmen	Tarsus
Tucopia, 2 ♀ ad.	221, 227	151, 153	29, 31	37, 38
" 3♂ imm.	230, 235, 237	155, 155, 159	30, 30, 32	38, 38, 40
" 1 ♀ imm.	223	146	30	37
Santa Anna, ♀ ad.	230		28	35
Guadalcanar, ♂ imm.	231	160	30	41
Guadalcanar, ♀ imm.	224	149	28	39

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[1] As some of the sexing may not be correct, the difference in size between males and females is perhaps greater than it appears in this table.

Range.—Tucopia Island (Santa Cruz group) (Feb. 1927); Santa Anna (Brit. Sol. Isls.) (March 1927); Guadalcanar (Brit. Sol. Isls.) (July 1927).

This material is not sufficient to decide to what subspecies these specimens belong. They agree in size fairly well with typical *melanoleucus*, but seem to differ in the coloration of the upperside; *melanoleucus* has the scapulars, wing-coverts and secondaries dark slate-gray with well-defined narrow black edges, while these black edges are broader and gradually merge into the blackish-gray centers in the above-named specimens. To show the difference in size between *brevicauda* and typical *melanoleucus*, I shall list some measurements of the latter.

Phalacrocorax melanoleucus melanoleucus (Vieillot)

Hydrocorax melanoleucus Vieillot, 1817, 'Nouv. Dict. d'Hist. Nat.,' nouv. éd., VIII, p. 88, March 15; Australasie [terra typica restricta: New South Wales].

Carbo melanoleucus melvillensis Mathews, 1912, Austral Av. Rec., I, pt. 3, p. 74, June 28; Melville Island, north Australia.

Measurements.—7 ♂ from Australia[1]: wings, 230, 232, 232, 233,[2] 238, 244, 250. 4 ♀ from Australia: wings, 221, 222, 223, 229. One (unsexed) from Amboina (Moluccas): wing, 235. 2 ♂, north New Guinea: wings, 235, 238; tail, 156, 165; bill, 28, 32; tarsus, 38, 41. Additional measurements in Meyer and Wiglesworth, 'Birds of Celebes,' p. 889.

The much larger size of these birds is conspicuous. Unfortunately, I have no specimens from the Pelew Islands and cannot decide whether it is the same bird as the Australian. In New Zealand there occurs a black phase ("*brevirostris*") with black breast and abdomen. But in the same colonies there are birds (in smaller number) with normal coloration and all kinds of connecting stages (see Oliver, 1930, 'New Zealand Birds,' pp. 184–186).

As there are apparently no other characters distinguishing the New Zealand birds from the Australian, it is doubtful whether we can use the name "*brevirostris*" in a subspecific sense.

3. **Demigretta sacra** (Gmelin)

Ardea sacra Gmelin, 1789, 'Syst. Nat.,' I, pt. 2, p. 640, April 20; Tahiti, Society Islands.

	Wing	Tail	Bill	Tarsus
♂ ad.	303	103	99	85
♂ semi-ad.	306	103	94	88
♀ ad.	289	101	85	79

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[1] Mr. A. Goodson, of Tring, kindly took these measurements for me.
[2] Type of *melvillensis* Mathews.

All three birds belong to the blackish-gray phase, although the adult male has a white stripe along the throat. Birds from the Moluccas and Sunda Islands seem to be smaller, but aside from that there seems to be no difference all over the wide range of this species, and the many described subspecies are only color-phases.

4. **Dupetor flavicollis pallidior,** new subspecies

TYPE.—No. 226424, Amer. Mus. Nat. Hist.; ♀ ad.; Rennell Island, May 21, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Similar to *woodfordi,* but above and underneath much paler; upperside hazel, against chestnut in *woodfordi;* foreneck and throat buff, instead of pale orange-cinnamon (Ridgway XXIX).

	WING	TAIL	CULMEN	TARSUS	MIDDLE TOE
Rennell, 2 ♀ ad.	188, 189	65, 69	78, 79	68, 69	58, 60
Sol. Is. 3 ♀ ad.	190–205	70–72	77–78	66–71	57–60

RANGE.—Rennell Island (collected May 1930).

The Whitney Expedition collected only two females on Rennell Island, but these two specimens are very different from the series of three adult and two young females from the Solomon Islands.

5. **Platalea leucorodia regia** Gould

Platalea regia GOULD, 1838, 'Synops. Birds Austr.,' pt. 4, App. p. 7, April 1; New South Wales.

	WING	TAIL	CULMEN[1]	TARSUS
1 ♀ semi-ad.	347	113	164	120

To find this species on Rennell Island is a most interesting discovery. The bird is apparently not quite adult, the sexual organs being indicated as "small." The tips of the primaries are still blackish, which seems to be a juvenal character, but the bill is black and the forehead bald.

Specimens from Australia, which Mr. Goodson, of Tring, kindly measured for me, have the following wing-lengths:

2 ♂, 360, 368; 2 ♀, 330 (type of *stalkeri*), 330.

I follow Stresemann's arrangement (Nov. Zool., 1912, p. 264) who regards, in my opinion with good reason, *regia* as a subspecies of *leucorodia.*

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[1] Not including the bare forehead.

6. **Threskiornis æthiopicus pygmæus**, new subspecies

TYPE.—No. 226420, Amer. Mus. Nat. Hist.; ♂ad.; Rennell Island, May 23, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Much smaller than *moluccus*, especially the bill much shorter.

	WING	TAIL	CULMEN	TARSUS	MIDDLE TOE
1 ♂ad.	339	118	132	95	77
4 ♂ semi-ad.	molting	99-107(103)	105-119(112.2)	75-79(76.8)	73-77(75.2)
3 ♀ semi-ad.	molting	104-105(104.3)	108-113(110)	74-81(77.7)	73-78(76)

RANGE.—Rennell Island (collected Sept. 1928 and May 1930).

The seven semi-adult specimens are molting from the juvenal to the adult plumage.

In four specimens of *moluccus* from southeast New Guinea (Hall Sound) (H. Hamlin, collector), I get the following measurements:

	WING	TAIL	CULMEN	TARSUS	MIDDLE TOE
4 ♂ ad.	360-374(364.5)	115-127(119.5)	177-196(187.2)	104-108(106)	90-95(93.5)

Further measurements of *moluccus* were kindly supplied by Mr. A. Goodson, of Tring.

	WING	CULMEN
New Guinea, ♂	368, 368	175-178
Seran, ♂	358	
New Guinea, ♀	350	152

Measurements of *strictipennis* are as follows:

Australia, 3 ♂	372,[1] 379, 382	196,[1] 197, 208
Australia, 2 ♀	350, 350	142, 156

The only difference between *strictipennis*, *moluccus*, and *pygmæus* seems to be the size. The color pattern on the secondaries varies to a great extent; in some specimens they are almost entirely black (with a metallic sheen), in others, as in the adult male from Rennell Island, strongly mottled with white. This variation appears to have no geographical significance (as Mr. Goodson informs me).

The birds from south New Guinea (Hall Sound) are in size somewhat intermediate between typical *moluccus* and *strictipennis*.

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[1] Type of *alligator* Mathews.

7. **Anas superciliosa pelewensis** Hartlaub and Finsch

Anas superciliosa var. *pelewensis* HARTLAUB AND FINSCH, 1872, Proc. Zool. Soc. London, p. 108; Pelew Island.

	WING	CULMEN	TARSUS
4 ♂ ad.	225–236(229)	43–46(44 5)	40–41(40.3)
3 ♀ ad.	206–214(210 4)	40–42(40 6)	35–38(36.6)

LOCALITY.—Rennell Island (Sept. 1928, May 1930).

The buff throat, the dark upperside with brownish edges of the feathers, and the short wing mark the specimens as *pelewensis*, which is widely distributed all over the Pacific Islands. There seem to exist some local size varieties (for example, the birds of the mountain lakes of New Guinea are larger), but it would not be wise for the present to split up the *pelewensis* group.

There is a marked difference in coloration between the two sexes which has been thus far overlooked. The female is generally lighter and the buff edges of the feathers of rump and upper tail-coverts are much wider, the white tips on the inner web of the secondaries are smaller and the 10th–12th secondary without (metallic sheening) black on the outer web.

8. **Anas gibberifrons gibberifrons** S. Müller

Anas (*Mareca*) *gibberifrons* S. MÜLLER, 1842, Verh. Nat. Gesch. Land-en Volkenk., p. 159; Celebes.

	WING	TAIL	BILL	TARSUS
1 ♂ ad.	185	75	32	31
1 ♀ ad.	177	72	31	30

It is very interesting to find this little duck so far east. It had been once recorded from New Caledonia (1860, Rev. Mag. Zool., (2) XII, p. 442), but never has been found on that island again. Besides that, the next known locality is south and southeast New Guinea.

The Australian birds (*Anas gibberifrons mathewsi* Phillips) have been separated from the Celebes birds on account of the slightly larger size, but the wing measurements are overlapping to a large extent (compare: Philipps, 1924, 'Natural History of Ducks,' II, p. 266; and Meise, 1930, Journ. f. Ornith., LXXVIII, p. 181). The Rennell birds agree in size with the Celebes specimens.

Both specimens are in freshly molted plumage (Sept. 1928).

9. **Accipiter fasciatus vigilax** (Wetmore)

Astur fasciatus vigilax Wetmore, 1926, Condor, XXVIII, p. 46.

New name for *Astur approximans insularis* F. Sarasin, 1913, 'Die Vögel Neu-Caledoniens und der Loyalty Inseln,' p. 8; *nec Astur insularis* Madarasz, 1910.

	Wing	Tail	Bill	Tarsus
♂ ad.	264	199	17	74
♀ ad.	285	230	20	80

Localities.—Rennell Island (1 ♂, Sept. 4, 1928) and Bellona Island (1 ♀, May 30, 1930).

Both specimens agree in size fairly well with *vigilax*. I have no New Caledonian or Australian material, but Mr. A. Goodson compared both specimens with the Australian *fasciatus* of Tring Museum and could not find any constant differences; *vigilax* is smaller than *fasciatus*, but seems to agree with it in coloration. As I have not seen any New Caledonian skins, I name the Rennell birds *vigilax*, only tentatively.

The male is in worn, the female in freshly molted plumage.

10. **Porphyrio albus melanopterus** (?) Bonaparte

Porphyrio melanopterus Bonaparte, 1856, Compt. Rend. Acad. Sci., Paris, LXIII, p. 599; no locality [terra typica restricta: Seran].

	Wing	Tail	Tarsus	Middle Toe
♂ ad.	237	88	85	93
♀ ad.	233	85	86	101

	Culmen (incl. shield)	Bill (from nostril)	Width of Shield
♂ ad.	70	30	27
♀ ad.	72	30	25

Locality.—Rennell Island (Aug. 1928).

Both specimens are rather worn.

All the Old World purple coots (except the much smaller *alleni*) represent each other. Whether they are considered subspecies or not, at least all the birds of the Sunda Islands, Australia, Melanesia, and Polynesia must be united into one species. The oldest available name is unfortunately *Fulica alba* White, 1790, which was given to an albinistic specimen of the (now apparently extinct) Norfolk Island race (see Mathews, 1911 'Birds of Australia,' I, pt. 5, pp. 250–254). The second oldest name is *Porphyrio cyanophalus* Vieillot, 1816.

From the range of *Porphyrio albus* (*calvus* auct.), Mathews ('Syst. Av. Austr.,' pp. 99–102) records not less than nineteen subspecies, some of which undoubtedly are synonyms. It would be only possible in a monographic revision to clear up the geographical variation of this species.

The Rennell birds have a rather dark, almost black back, scapulum, and wing; the shield on the head is very wide and the blue on the wing-bend, throat and upper breast is of a pure shade, not greenish, as in the Polynesian and Solomon Islands birds. The scanty material available to me does not permit me to separate the Rennell specimens from *melanopterus.*

11. **Sterna sumatrana sumatrana** Raffles

Sterna sumatrana Raffles, 1822, Trans. Linn. Soc. London, XIII, pt. 2, p. 329; Sumatra.

	Wing	Bill	Tarsus
2 ♂ ad.	230, 235	35	30

Locality.—Rennell Island (Sept. 1928, May 1930).

Both specimens are in fresh plumage, but the bird does not seem to breed on Rennell Island.

There are apparently no subspecies in the eastern part of the range of this widespread species. The wing measurements of the two Rennell specimens are rather large for *sumatrana,* but the length of the bill is the same as in typical birds, while *mathewsi* Stresemann has a longer bill.

12. **Sterna bergii cristata** Stephens

Sterna cristata Stephens, 1826, in Shaw's, 'Gen. Zool.,' XII, p. 146; China.

	Wing	Bill	Tarsus
♂ imm.	340	57	29
♀ imm.	332	53	28

Locality.—Rennell Island (Sept. 1928).

Both specimens are immature, in a rather worn condition, and in partly molted body plumage.

I refer these birds to *cristata,* which seems to be distributed all over the tropical waters of the Pacific Ocean. The coloration of the back is not of a very high systematic value. One of the two specimens (♂) has a dark back, the other (♀) a very light one. Hartert 'Vögel Pal. Fauna,' p. 1717) also says that he got dark-colored birds from the Pacific as well as light-colored ones. Size seems to be the best distinguishing character between the different subspecies.

13. **Anous stolidus pileatus** (Scopoli)

Sterna pileata Scopoli, 1786, 'Del. Faun. et Flor. Insubr.,' II, p. 92; Philippine Islands.

	Wing	Bill	Tarsus
3 ♂	279	40, 42	26, 27, 27
4 ♀	275, 278, 284	40, 40, 41	26, 26, 27

Locality.—Rennell Island (Sept. 1928).

All the specimens are either molting or in a very worn condition; the measurements are therefore only approximately correct.

14. **Ptilinopus rhodostictus cyanopterus**, new subspecies

Type.—No. 224471, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island, Aug. 28, 1928; Hannibal Hamlin.

Subspecific Characters.—Similar to *rhodostictus* Tristram, but the bill shorter and thicker; the green on the scapulars, mantle, back, rump, and upper tail-coverts deeper (more moss-green than olive-green); the bluish sheen of the wing-feathers and base of the tail-feathers much more pronounced; the olive edges of the wing-coverts smaller; the red patch on the belly less orange (flame-scarlet against orange-chrome in *rhodostictus*); the crown pure gray without any violet tinge; slightly larger.

Males, adult: wings, 133–141 (137.4); tail, 75–77. Females, adult: wings, 131–138 (134.4). Birds in first year plumage: wings, 129–135 (131). Weight of 2 males, adult: 115 and 116 grs.

The typical subspecies of this rare little dove was discovered on Ugi Island (Brit. Sol. Islands) by Richards in 1880, and in the following years collected by Morton and Lewis on the same island, but never recorded after 1882. It was found again (and collected in small numbers) by the Whitney Expedition on Ugi Island and on Santa Anna Island.

It seems to be restricted to the small islands along the north coast of San Cristobal Island. The species has geographical representatives east and west of the Solomon Islands (superspecies *Ptilinopus porphyraceus*), which have been reviewed recently by Rensch (1929, Verh. VI. Internat. Ornith. Kongress, Berlin, p. 235, with map).

15. **Ducula pacifica tarrali** (Bonaparte)

Globicera tarrali Bonaparte, 1854, Compt. Rend. Acad. Sci., Paris, XXXIX, p. 1073; Vanikoro Island, Santa Cruz group.

Carpophaga Frauenfeldii Pelzeln, 1865, 'Reise der Novara,' Zool. Theil I, p. 106, Stewart Island (Sikaiana).

	Wing	Tail	Bill	Weight
5 ♂ ad.	235, 240, 241	138, 141, 145	28–29	400, 550, 550
	242, 253	150		
2 ♀ ad.	232, 232	140	28, 28	420
1 ♀ imm.	225	137	28	

LOCALITY.—Rennell Island (Aug.–Sept. 1928 and May 1930).

All specimens (from May, Aug., and Sept.) are molting wing and tail-feathers.

The classification of this species is in a state of great disorder. The bird has a very extended range, but occurs within this area only on certain localities. All those belonging to the western part of its range seem to correspond to *tarrali*. After a careful examination of the large series in the American Museum, I arrive at the conclusion that the birds from the Santa Cruz group, Stewart Island, Gower Island, Rennell Island, Florida Island, the Louisiade Archipelago, and the islands off the north coast of New Guinea (Tarawai and Seleo) should be grouped under this name; but it needs a monographical treatment to reach a final decision.

The individual variation is much greater than it has hitherto appeared in descriptions of this species. I have before me, in series from the same localities, specimens with bluish-green and with bronze-green back, with a large knob on the base of the bill and almost none; with a light gray head and hind-neck and with a dark one; with a distinct gray tinge on the breast and with a pure vinaceous breast; with a light-colored belly and with a chestnut-colored one, etc.

The birds from Rennell Island compared with typical Vanikoro specimens show a tendency towards a lighter coloring of neck and underside; the breast is usually more vinaceous (less gray), and the knob on the bill more pronounced; but most of the specimens of the two localities cannot be distinguished from each other.

When Pelzeln described *frauenfeldii* (*loc. cit.*) he compared it with two such distinct species as *ænea* Linnæus (India) and as *myristicivora* Scopoli from Waigiu (called *sundevalli* by Pelzeln). Naturally he found quite a lot of differences. Unfortunately, Steward Island (now called Sikaiana) has never been visited by an ornithologist since the voyage of the 'Novara,' but I have a series of *Ducula pacifica* from Gower Island (northwest of Malaita) which is the nearest locality to Stewart Island where this species occurs. These birds do not differ noticeably from Vanikoro specimens. We can safely conclude that *frauenfeldii* is an absolute synonym of *tarrali*.

Geographical representatives of the species *Ducula pacifica* are: in the west, *Ducula myristicivora;* in the north, *Ducula oceanica;* in the east, *Ducula aurora* and "*Serresius*" *galeatus*.

Concerning the invalidity of the genus *Globicera*, I quite agree with Hartert (1901, Nov. Zool., VIII, p. 111).

16. **Gallicolumba beccarii solomonensis** (Ogilvie-Grant)

Phlogœnas solomonensis Ogilvie-Grant, 1888, Proc. Zool. Soc. London, p. 200; Aola (Guadalcanar, Brit. Sol. Isls.).

	Wing	Culmen	Tarsus	Weight
1 ♂ ad.	108	15	28	95
3 ♂ imm.	109–117	14	28–30	82–83
3 ♀ ad.	103, 105, 108	14–15	27–28	76, 79, 82
2 ♀ imm.	98, 104	14	26, 27	71, 82

Locality.—Rennell Island (Aug. 1928 and May 1930).

The adult birds are freshly molted, the immature specimens molting the body plumage into the adult one.

Compared with Solomon Islands specimens, the Rennell birds show a tendency to have the back and nuchal patch more purplish; the belly darker chocolate-brown, and the lower edge of the breast-shield lighter (more whitish); but in every one of these characters there is a wide margin of individual variation. I have, for example, two specimens from Santa Anna Island (both are males with large testes, shot in March 1927), one of which has the back dark purplish, and the belly coffee-brown; while the other one has the back with a greenish sheen and the belly grayish beige.

Rothschild and Hartert (1905, Nov. Zool., p. 246) described a subspecies "*intermedia*" from the western Solomon Islands on account of slight color differences and considerably smaller size; but they gave no measurements, which is not a very scientific procedure.

Gallicolumba beccarii johannæ (Sclater) differs from *solomonensis* by the smaller bill, smaller nape-patch, and by the constantly lighter coloration of breast-shield and abdomen.

17. **Calœnas nicobarica nicobarica** (Linnæus)

Columba nicobarica Linnæus, 1758, 'Syst. Nat.,' 10 Ed., p. 164; Nicobar Islands.

	Wing	Tail	Bill	Tarsus
1 ♂ ad.	271	90	26	43

Locality.—Rennell Island (May 1930).

The bird is in freshly molted plumage.

The specimen agrees perfectly with Solomon Island specimens. Birds from the western part of the range of this species (including Nicobar Islands) seem to have a different sheen on the upperside; not almost pure greenish, with just a little coppery tinge, but distinctly bronze coppery, sometimes even almost purplish. But Mr. Goodson assures me (after having examined the Tring material) that Nicobar birds do not differ from Solomon Island specimens.

18. **Lorius**[1] **chlorocercus** Gould

Lorius chlorocercus GOULD, 1856, Proc. Zool. Soc. London, p. 137; San Cristobal Island (Brit. Sol. Isls.).

	WING	TAIL	CULMEN	WEIGHT
1 ♀ ad.	152	90	20.5	150
2 ♂ imm.	154, 157	85, 86	20.5, 22	

The adult bird (collected in May 1930) has nearly finished its molt; the two young birds (Sept. 1928) are in a rather worn condition and beginning to molt their body plumage.

The thighs of the Rennell birds are lighter blue and the wing-band less whitish than in a large series of *chlorocercus* from San Cristobal, but the Rennell material is too small to decide if this character is constant.

19. **Geoffroyus heteroclitus hyacinthinus,** new subspecies

TYPE.—No. 226433, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island, May 25, 1930; Hannibal Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Males: the Ontario violet (Ridgway XXXVI) of throat and upper breast is extended all over the breast, flanks, and upper abdomen; on the nape also the violet color is more extended, reaching the foreback; wing-bend bluish, blue edges of primary-coverts much wider. Female: primary-coverts more bluish, the bluish gray of the head deeper and more extended on the sides and on the neck.

	WING	TAIL	BILL	WEIGHT
3 ♂ ad.	173, 175, 176	97, 101, 101	21, 22	200
4 ♀ ad.	169–178 (175)	99–102 (100.2)	21–21.5	210

RANGE.—Rennell Island (collected Aug.–Sept. 1928 and May 1930).

The May specimens are freshly molted, the birds from September slightly worn.

20. **Micropsitta finschii finschii** (Ramsay)

Nasiterna Finschii RAMSAY, 1881, Proc. Linn. Soc. N. S. W., VI, p. 180; San Cristobal.

	WING	TAIL	BILL	WEIGHT
1 ♂ ad.	66	33	8.5	16

I cannot discover any differences between this specimen (collected May 1930) and a large series of typical *finschii* from San Cristobal, which is the more remarkable as *finschii* has several subspecies in the Solomon Islands.

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[1] *Lorius* Brisson, 1760, Ornithologia, IV, p. 215; type (by subs. design., Gray, 1840, 'Genera of Birds,' p. 52); *Psittacus domicella* L. Syn.: *Domicella* Wagler, 1832 (Monogr. Psitt.), Abh. Akad. Wissensch. München, I, p. 495; type (by tautonymy): *Psittacus domicella* L.

21. **Cacomantis pyrrhophanus meeki** Rothschild and Hartert

Cacomantis meeki ROTHSCHILD AND HARTERT, 1902, Nov. Zool., XIV, p. 436; Ysabel Island (Brit. Sol. Isls.).

	WING	TAIL	TARSUS	WEIGHT
1 ♀ imm.	140	147	18 5	54

Iris, orange; eyelids, yellow; bill, black; feet, yellow-brown.

The specimen (collected on Bellona Island, May 1930) almost completed its molt to the adult plumage, but there are still left some juvenal feathers on the hind-neck and among the scapulars and upper wing-coverts. The bill has the tip shot off and cannot be measured.

Mr. A. Goodson kindly compared the specimen with the series of *meeki* in the Tring Museum (including the type) and could not find any differences in size or coloration, except that the upper tail-coverts in the Rennell specimens have very conspicuous white markings which are only slightly indicated in the Solomon Island specimens. It needs additional material to decide whether or not this character is constant.

22*a*. **Chalcites lucidus lucidus** (Gmelin)

Cuculus lucidus GMELIN, 1788, 'Syst. Nat.,' I, pt. 1, p. 421 (in nova Selandia).

	WING	TAIL	WEIGHT
3 ♂ ad.	90, 93, 95	62, 63, 64	19, 20, 20 5

All three specimens (collected on Rennell Island, May 1930) are in fresh plumage, one is still molting, and the sexual organs are small.

22*b*. **Chalcites lucidus plagosus** (Latham)

Cuculus plagosus LATHAM, 1801, 'Index Ornith.,' Suppl. 2, p. xxxii ("hab. in Nova Hollandia").

	WING	TAIL	WEIGHT
2 ♀ ad.	90, 95	60, 63	19

Both specimens (collected on Bellona Island and Rennell Island, May 1930) are just at the end of their molt.

According to all descriptions the five specimens of glossy cuckoos collected on Rennell Island should be classified as above. In the two "*plagosus*" the head and back is much more purplish, the throat has a rusty tinge and the two outer tail-feathers are strongly marked with rusty chestnut. On the other hand, it might be just a sexual difference. The measurements are rather small for *lucidus* and *plagosus*.

23. **Collocalia esculenta desiderata,** new subspecies

TYPE.—No. 226447, Amer. Mus. Nat. Hist.; ♀ ad.; Rennell Island; May 25, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—In size and general coloration similar to *uropygialis*, but feathers of rump and shorter upper tail-coverts not entirely white, but just with white edges; upper surface dull bluish-green, gray of throat restricted and sharply separated from white of belly.

	WING	TAIL	WEIGHT
4 ♂	95–97(96 5)	39–40	5 5
7 ♀	96–101(99 1)	39–41	5.5

This new form is the long-desired missing link between *esculenta* and *uropygialis*. It combines characters of both subspecies. For *uropygialis* I find a wing measurement of 95–100 mm.

REVISION OF THE SUBSPECIES OF *Collocalia esculenta* IN THE SOLOMON ISLANDS

A large amount of material from the American Museum, the Tring Museum, and the Berlin Museum (altogether 192 skins) permits me to give a review of the subspecies inhabiting the area between New Guinea and the New Hebrides.

The species of the genus *Collocalia* have the same peculiarity, which I mentioned in my paper on *Halcyon chloris* (*loc. cit.*, p. 7) of showing slight differences on every island; but it would lead too far to name every one of the different populations, so I shall describe the differences only and give names solely to those populations that show very distinct characters. The females usually exceed the males in size, but I have not separated the measurements of both sexes in the following tables, as most of the material is very badly sexed. Wear has some effect on the coloration, as worn specimens are more bluish on the upper side and blacker on the throat after having the white edges of the feathers worn off.

Collocalia esculenta makirensis, new subspecies

TYPE.—No. 217434, Amer. Mus. Nat. Hist.; ♀ ad.; San Cristobal Island; April 4, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Very small, similar to *desiderata*, but less dull above and without white edges on the central rump feathers; gray of breast sharply separated from white of belly.

Measurements of 10 specimens collected on San Cristobal (March and April 1927 and December 1929): wings, 91–96 (93.9).

DISTRIBUTION.—San Cristobal Island, also called Makira or Bauro (British Solomon Islands).

Collocalia esculenta becki, new subspecies

TYPE.—No. 217501, Amer. Mus. Nat. Hist.; ♂ ad.; Florida Island, June 20, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Upperside more glossy than in *makirensis* and *desiderata*, but not as much as in *stresemanni;* sheen bluish green, not greenish; underside very different from the hitherto mentioned forms, the feathers of the belly not being more or less white but greenish gray with narrow white edges; there is a great deal of variation in this character, but in some specimens the whole underside appears to be dark scaly gray.

DISTRIBUTION.—Guadalcanar Island, Florida Island, Pavuvu Islands, central Solomon Islands (Tetipari, Kulambangra, Bagga and Vella Lavella), northern Solomon Islands (Ysabel, Choiseul, Shortland, and Bougainville). As I stated above (p. 15), the birds from the different islands of this range do not agree perfectly, so I shall list them separately in the following tables of measurements. I choose Florida Island as terra typica, it being the most visited island of the British Solomon group, the capital, Tulagi, being situated on it.

I name this new subspecies in honor of R. H. Beck, who collected more specimens of *Collocalia* on the Solomon Islands than anyone before him.

Florida Island (June, 1927), typical *becki*: wings, 98, 98, 98, 101, 103 (99.6).

Guadalcanar Island (July, 1927): wing, 104.

Pavuvu Islands (August, 1927): wings, 101, 101, 102, 104, 105, 106, 107 (103.9).

These specimens are very similar to typical *becki*, but a little more glossy above and with more white on the belly.

Tetipari Island (Aug. 1928): wings, 98, 99.

Kulambangra Island (Oct. 1927): wings, 100, 102, 104.

Bagga Island (Nov. 1927): wing, 100.5.

Vella Lavella Island (Oct., Nov. 1927): wings, 98, 99, 99, 100, 100, 101, 101, 102, 106.

The specimens from the central Solomon Islands are very similar to typical *becki*, but usually more glossy and more greenish above.

Ysabel (July 1901, Meek Coll.): wings, 99, 99, 101, 101, 102, 104.

Choiseul (Jan. 1904, Meek Coll.): wings, 98, 99.

Breast and flanks are distinctly lighter gray, back more greenish; but as the Bougainville specimens are very similar again to typical *becki*, I do not dare to separate the birds of Ysabel and Choiseul.

Shortland Island (Dec. 1927): wing, 101.

Bougainville Island (Dec. 1927, Jan. 1928): wings, 101, 101, 102, 102, 103, 103, 104, 106, 109, 109 (104).

Similar to typical *becki*, but in the average larger, with more white on the belly and more glossy above.

Nissan Island (July, Aug., Sept. 1924, Eichhorn; Aug. 1929, Hamlin and Mayr): wings, 96, 96, 96, 96, 98, 98, 99, 99 (97.2).

Similar to typical *becki* (being duller and smaller than the Bougainville specimens), but more greenish above and with more white on the belly.

Collocalia esculenta stresemanni Rothschild and Hartert

Collocalia esculenta stresemanni Rothschild and Hartert, 1914, Nov. Zool., XXI, p. 239; Manus, Admiralty Islands.

Collocalia uropygialis heinrothi Neumann, 1919, Ornith. Monatsber., XXVIII, p. 110; Nusa Island, New Ireland [type examined].

Collocalia esculenta tametamele Stresemann, 1921, Anzeiger Ornith. Ges. Bayern, No. 5, p. 37; Ralum, New Britain [type examined].

Subspecific Characters.—Very glossy above, as *esculenta*, but smaller, feathers on the side of the rump sometimes with white edges; white area on belly more restricted; *becki* is much duller above and has less white on the belly.

New Britain: wings, 98, 99, 101, 102.[1]
Witu Islands: wings, 96, 99, 101, 102.
New Ireland: wing, (molting).[2]
New Hanover: wings, 95, 96, 96, 98.

Distribution.—Admiralty Islands and Bismarck Archipelago.

Specimens of *esculenta* Linnæus from northeast New Guinea (Bürgers, Mayr, Beck coll.) have the following wing-measurements: 102, 103, 104, 104, 106, 106, 109 (105).

Specimens from New Britain and the Witu Islands have the throat and upper breast very dark (metallic), while in those from New Ireland and New Hanover they are lighter and more grayish. Two of the New Hanover specimens are abnormal in the coloration of the rump, the pigmentation has been interrupted during the molt, perhaps on account of hunger and cold weather. The type of *heinrothi* Neumann seems to be an albinistic specimen.

24. **Hemiprocne mystacea woodfordiana** (Hartert)

Macropteryx mystacea woodfordiana Hartert, 1896, Nov. Zool., III, p. 19; Guadalcanar (Brit. Sol. Islands).

	Wing	Longest Tail-feather
♂ ad.	215	181
	211	182

There is no difference from typical *woodfordiana*, except that the two Rennell birds (collected Aug. 1928) have the gray on upperside and underneath slightly darker (especially) on rump and under tail-coverts), and that the size is a little larger. Both specimens are in fresh plumage.

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[1] Type of *tametamele* Stresemann.
[2] Type of *heinrothi* Neumann.

25. **Halcyon chloris amœna** Mayr

Halcyon chloris amœna Mayr, 1931, Amer. Mus. Novitates, No. 469, p. 10; Rennell Island.

The necessary data already have been given in the original description (*loc. cit.*). The weights of two specimens are 45 and 45.5 grs. The May specimens are just at the end of the molt, the August birds in rather fresh plumage.

26. **Halcyon sancta** Vigors and Horsfield

Halcyon sanctus Vigors and Horsfield, 1827, Trans. Linn. Soc. London, XV, p. 206; New South Wales.

	Wing	Tail	Bill
3 ♂ ad.	91, 91, 92	(58)	30, 32, 33
1 ♀ imm.	92	57	31

The three adult birds (collected in August) have almost completed their molt; the young specimen is in very worn plumage (weight 46 grs.).

27. **Coracina lineata gracilis,** new subspecies

Type.—No. 226212, Amer. Mus. Nat. Hist.; Rennell Island, August 30, 1928; H. Hamlin.

Subspecific Characters.—Similar to *lineata* from Australia, but smaller and darker; the gray of upperside, throat, wings and under tail-coverts much darker; lower breast, belly, under wing- and under tail-coverts in both sexes narrowly barred with black and white; the black bars being broader than the white ones. There is no difference between the two sexes, except that in females usually the white bars on the under tail-coverts are broader, in the males the black ones.

	Wing	Tail	Weight
4 ♂	143–146(144 2)	103–110(105.5)	94
1 " ♀ " (? ♂)	143	105	
3 ♀	138, 138, 139	97, 98, 98	81, 90
1 ♀ imm.	140	100	83

Range.—Rennell Island (collected Aug.–Sept. 1928, and May 1930).

In *lineata* from Australia the wing is about 145–151.

The May (1930) specimens are in very fresh plumage, the Aug.–Sept. (1928) birds slightly worn.

It is remarkable that the Rennell bird is so unlike the Solomon Island subspecies of *lineata*, in which there is always a marked sexual dimorphism.

28. **Aplonis cantoroides cantoroides** (Gray)

Calornis cantoroides GRAY, 1862, Proc. Zool. Soc. London (1861), p. 431; Mysol Island.

	WING	TAIL	INDEX[1]
1 ♂ ad. (testes small)	103	69	67.0
Wing formula:	4>3>2>5		

It is unexpected to find a typical *cantoroides* on Rennell Island, which agrees in every detail with a large series from the Solomon Islands. More collecting is necessary in order to find out whether this species is breeding on Rennell Island or not. For the present the occurrence of this one specimen, collected on Rennell Island, Sept. 4, 1928 (which might be a straggler from the Solomon Islands), forces me to treat the undoubtedly indigenous Rennell Islands starling as a distinct species.

29. **Aplonis insularis**, new species

TYPE.—No. 226540, Amer. Mus. Nat. Hist.; ♂ ad; Rennell Island; May 21, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyderdam.

SPECIFIC CHARACTERS.—Similar to *cantoroides*, but differing in the following points: bill stronger and upper mandible more curved; the glossy edges of the feathers of back, wings, and underside more narrow and bluish green, instead of bottle-green; all the plumage softer, less compact; the feathers of throat, upper breast and neck shorter, less lanceolate; juvenal plumage very different (see below); slightly larger; different proportions and wing-formula. Wing, 101–109; tail, 50–59; tarsus, 25–27; exposed culmen, 17.5–19.5.

DESCRIPTION.—Male and female (adult plumage).—General color black, feathers with glossy bluish-green edges, more greenish on the head, the sides of the neck and throat; more bluish on the scapulars, back, rump, and belly; feathers of hindneck and throat slightly lanceolate; wings and tail black with a greenish sheen.

FIRST YEAR PLUMAGE (male and female).—General color dark brownish-gray with a slight metallic sheen produced by narrow glossy feather-edges.

NESTLING PLUMAGE (male and female).—Plumage very soft and loose; upper side earth-brown; under side lighter (hair-brown) with buff edges to the feathers of the belly; no glossy feathers at all.

The species of *Aplonis* molt twice before reaching the adult plumage as described by Heinroth (1903, Journ. f. Orn., p. 75) and Stresemann (1914, Nov. Zool., XXI, p. 151).

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[1] Index $= \frac{\text{Tail} \times 100}{\text{Wing}}$

Measurements of specimens collected on Rennell Island (Aug., Sept., 1928; May, 1930)

	WING	TAIL	INDEX	WING-FORMULA	WEIGHT
♂ ad.	106	59	55 7	4>3>5>2	
♂ ad.	107	59	55 2	4=5>3>2	66
♂ ad.	108	56	51 9	Molting	74
♂ ad.	108	59	54 6	4=3>5>2	
♀ ad.	109	56	51 4	4>3>5>2	
♀ ad. (?)	104	53	51 0	4=5>3>2	
♂ imm.	103	55	53 4	3>4>5=2	66
♀ imm.	104	57	54 8	3>4>5>2	
♂ juv.	103	52	50 5	4>3>5>2	
♀ juv.	101	50	49 5	3=4>5>2	
♀ juv.	102	51	50 0	3=4>5=2	
♀ juv.	101	50	49 5	3=4>5>2	

COMPARISON OF *insularis* WITH RELATED SPECIES

There is undoubtedly a faint relation to the starlings of the Polynesian Islands and New Hebrides Islands, but *insularis* is more closely related to *cantoroides,* so close that I might consider it a subspecies of that species if a specimen of *cantoroides* had not also been collected on Rennell Island.

The whole group of starlings related to *cantoroides* has not been fully understood thus far. There is *Aplonis cantoroides cantoroides* with a very wide distribution, reaching from the Aru Islands and western Papuan Islands over all New Guinea, Bismarck Archipelago to the Solomon Islands without any geographical variation, and there are (besides *insularis*) three forms occurring within this range, but every one restricted to one group of coral islands; *feadensis* Ramsay, on the Fead or Abgarris Island (northeast of the Solomon Islands), *longipennis* Neumann, on Nissan Island, and *heureka* Meise on the Ninigo and Matty Islands. All these three forms are apparently rather different from *cantoroides* and intermediate between *cantoroides* and *insularis;* in some characters these "subspecies" differ even more from *cantoroides,* than *insularis.*

More collecting on the atolls north of the Solomon Islands and in the Bismarck Archipelago and Admiralty Islands is necessary for a full understanding of the relations between the different forms. For the present I confine myself to pointing out the peculiarities of *cantoroides, heureka, longipennis,* and *insularis.* There is no material available of *feadensis,* which has been recorded only once since its original description (see P. Z. S. L., 1883, p. 347).

Measurements of adult birds of the four forms follow.

	WING	TAIL	INDEX	WEIGHT
cantoroides (8)	99–106	62–70	61.8–67.3[1]	54–66
longipennis (12)	116–125	65–75	56.0–61.2	67–87
heureka[2] (4)	122–125	79–82	63.7–67 2	
insularis (6)	104–109	53–59	51.0–55.7	66–74

WING-FORMULA.—The normal wing-formula of *cantoroides* is $2>3>4>5>6$; the second and third primary are almost equal in length, sometimes even the third one longer than the second; but I found only three cases in a series of over 35 specimens where the second primary was visibly shorter than the third and fourth primaries ($3>4>2>5$).

In a series of 12 adult *longipennis*, I find a much rounder wing, the second primary is always shorter than the 3d, 4th, and 5th. The usual formula is: $4>3>5>2$, with some possible variations as: $4=3>5>2$, $4>3=5>2$ and $3>4>5>2$.

In *heureka* the wing is more pointed, but (according to information from Prof. Stresemann) shows a great deal of variation. Three adult males which I collected have the following wing-formula: $3=4>2>5$, $3=4>2>5$ (type!), and $4>3>2>5$; three additional birds (Mayr and Kramer, collectors) show: $4>3>2>5>6$ (juv.!), $3>2>4>5$ and $3=4=2>5$.

The wing-formulæ of *insularis* are listed above. The wing is very round and agrees more or less with the one of *longipennis*. In *insularis* and *longipennis* the first primary is reduced much less than in *cantoroides*.

PLUMAGE.—In *cantoroides* the feathers of the neck and throat are narrowly pointed (lanceolate); this is less so in the case of *heureka*, even less in *insularis*, and reaches the extreme in *longipennis*, where the feathers of the neck are round and only the feathers of the throat are slightly pointed.

30. **Turdus poliocephalus rennellianus**, new subspecies

TYPE.—No. 226493, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; May 28, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Differs from *papuensis* and *heinrothi* by the deeper coloration (more saturated black) and from *vanikorensis*, *samoensis*, and *mareensis* by the much smaller size, the light patch on the lower belly and the rust-colored tips of the under tail-coverts.

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[1] These measurements are taken from Solomon Islands specimens. For New Guinea specimens Meise found (Orn. Monatsber., 1929, p. 112) the identical index: 62–67.

[2] See Meise (*loc. cit.*), p. 111.

Description.—Male: upperside dark fuscous-black, underside slightly lighter; feathers of the middle and lower belly narrowly edged with cinnamon; feathers on the middle of lower belly sometimes with whitish edges; under tail-coverts with rusty tips; thighs rust-colored; in worn plumage the fuscous-black feathers of the body fade to brownish.

Female: similar to male, but above and below more brownish; feathers of underside, except throat and breast, with buffy or rusty edges; feathers of lower belly with broad whitish tips; under tail-coverts with rusty or whitish shaft-stripes and tips.

Juvenal: Similar to female adult, but very variable; plumage softer and underneath lighter than adult; lores, malar stripe, and chin sometimes buffy.

Bill and feet cadmium-yellow; iris dark brown.

	Wing	Tail	Tarsus	Weight
♂♂ ad.	100–107(104.1)	65–73(68.8)	31–32	52–61(56 5)
♀♀ ad.	101–103(102 3)	62–70(66.3)		57–67(63)
juvs.	94–99	61–63		57

Range.—Rennell Island (collected Aug. 1928 and May 1930).

I consider all the Australonesian thrushes with yellow bills and legs subspecies of one species, of which the oldest name is *poliocephalus* Latham. It is a peculiarity of this species that some of its subspecies inhabit small coral islands, whereas others inhabit the high mountains of the larger islands.

31. **Gerygone flavolateralis citrina,** new subspecies

Type.—No. 226506, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; May 16, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

Subspecific Characters and Description.—Rather different from *correiæ;* the grayish white of throat and upper breast is much lighter and less extended, not covering the whole breast; lower breast, abdomen, flanks and under tail-coverts bright sulphur-yellow; back warbler-green (Ridgway IV) against olive-citrine (R. XVI) in *correiæ;* wing-coverts, primaries and secondaries edged with the color of the back; rump lighter; upper tail-coverts dusky olive; forehead, pileum, and neck ash-gray with a slight olive tinge; lores, superciliary stripe, and feathers on lower eyelid whitish; axillaries and carpal edge yellow; under wing-coverts whitish with yellow tips; ear-coverts and sides of throat gray, with a slight brownish tinge; much less white in the tail as in *correiæ* or *flavolateralis.* There is a distinct white spot only on the inner web of the three outer tail-feathers; on the three inner tail-feathers there is a lighter shaded area on the inner web, but no white spots; no white is found on the outer web of any tail-feather; a dark subapical band goes across the tail-feathers basad of the white spots.

Iris yellow white; bill and feet black; weight 7.5 gr.; tarsus, 18.0–19.5; culmen, 10–11 mm.

	Wing	Tail
6 ♂	53–55(54.1)	39.5–40 5(40)
2 ♀	52, 54	39, 39

Range.—Rennell Island (collected Aug. 1928 and May 1930).

This species is widespread in eastern Melanesia and reaches from New Caledonia and the Loyalty Islands (see, Ibis, 1917, pp. 422–428, and Sarasin, 1913, 'Die Vögel Neu Caledoniens,' pp. 20–22), over the New Hebrides and Banks Islands as far as Rennell Island.

The subspecies of the New Hebrides, which was discovered there by the Whitney South Sea Expedition, I name in honor of Mr. J. G. Correia, an able member of the expedition.

Gerygone flavolateralis correiæ, new subspecies

TYPE.—No. 212594, Amer. Mus. Nat. Hist.; ♀ ad.; Epi Island, New Hebrides; August 5, 1926; R. H. Beck and J. G. Correia.

SUBSPECIFIC CHARACTERS.—In coloration intermediate between *flavolateralis* and *citrina*, differing from *flavolateralis*[1] by the brighter yellow of belly and flanks, and the more greenish, less dusky grayish-olive color of the back; tail with less white; white on the outer web of the outermost tail-feather restricted; there is a distinct (in size gradually decreasing) white spot on the inner web of the four outer tail-feathers, a light area on the fifth and no white at all on the innermost tail-feather.

WING MEASUREMENTS.—New Hebrides: Mai Island (July 1926), 50–52; Epi Island (Aug. 1926), 50–53; Lopevi Island (Aug. 1926), 50–52; Ambrym (Aug. 1926), 49.5–51; Malekula (Aug. 1926), 51; Aoba (Jan. 1927), 49–52. Banks Islands: Gaua Island (Sept.–Nov. 1926), 49–54 (52); Vanua Lava (Nov. 1926), 47–54 (51).

Typical *flavolateralis* (New Caledonia) have a wing of about 50–53 mm.

The juvenal plumage is rather different from that of the adult. The back is dusky brownish-olive, the head dusky olive, the sides of the head yellowish green; underside (yellowish) white with a dusky band across the breast. The bird described by Sarasin as *Pseudogerygone rouxei* seems to be in immature plumage.

32. **Pinarolestes hamlini**, new species

TYPE.—No. 226254, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; August 29, 1928; H. Hamlin.

DESCRIPTION.—Male adult: forehead, anterior part of crown, circumocular ring, superciliary, lores, cheeks, auriculars, and upper throat black, forming a black mask; crown snuff-brown (Ridgway XXIX); back cinnamon-brown, more russet towards the rump (R. XV); the edges of the wing-coverts and secondaries colored as the back; the edges of the primaries are darker rusty; wing- and tail-feathers earth-brown, the basal edges of the latter rust-colored; under side ochraceous-rusty, deeper on the breast, the sides of the neck and flanks; middle of belly and under tail-coverts lighter; some specimens are distinctly more rust-colored on back and underside; smaller under wing-coverts blackish; larger under wing-coverts and axillaries white; thighs black with buff feather edges.

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[1] Examined: ♂1, 1 ♀, Ba Bay, and 1 ♂ Mt. Panie (P. D. Montague coll.) which were kindly loaned to me by the Tring Museum.

Female adult: similar to male, but duller; thighs brownish black.

Juvenal: similar to female adult, but still duller, especially on the black mask; smaller under wing-coverts and thighs brown; tail-feathers narrower and more pointed.

Iris brown, bill bluish slate-gray with a white tip; feet dark bluish-gray. Bill (from nostril) of ♂ ad., 20–20 5; of ♀ ad., 19.5–20; exposed culmen about 8 mm. longer; tarsus, 23–24 mm.

	Wing	Tail	Weight
♂ ad.	94–101(98.4)	76–85(79.4)	35–37(36.3)
♀ ad.	92–98(96)	74–81(77.8)	32–40(36.7)
♂ imm.	92–97(94.6)	77–80(78 2)	32, 35
♀ imm.	90, 90	76–79(77.6)	31, 31

Range.—Rennell Island (collected Aug. 1928 and May 1930).

I name this fine new species in honor of my friend, Mr. Hannibal Hamlin, who by his energy and courage secured this collection.

I have hesitated for some time to include this species, with its tremendously long bill, in the genus *Pinarolestes*. However, after a close study of the two related species (*vitiensis* and *macrorhynchus*), I find no character on which to base a separation. *Pinarolestes* is not a genus of shrikes, as we find it in most of the modern reviews and catalogues, but it is most closely related to the two genera of flycatchers—*Monarcha* and *Pomarea*.

To fit *Pinarolestes* into Sharpe's Key ('Cat. Birds,' IV, pp. 118, 119) would lead to trouble, as in *vitiensis* the second primary is longer than the secondaries; in *macrorhynchus* it is equal, and in *hamlini* shorter. The wing-formula of the latter is: 5>4>6>7>3>8>9>10>2.

The New Guinea genus *Myiolestes* (type, *megarhynchos*) has a much shorter tail, stouter bill, and softer plumage on the forehead. It belongs, together with *Pachycephala*, to a different subfamily of the Old World flycatchers.

33. **Myiagra vanikorensis occidentalis**, new subspecies

Type and only Specimen.—No. 225650, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; September 4, 1928; H. Hamlin.

Subspecific Characters.—Similar to *Myiagra vanikorensis melanura* Gray, but bill much shorter and broader; the white edges on the tail-feathers broader; the glossy parts of breast and head duller; back and rump more distinctly gray; axillaries purer white.

Measurements.—Wing, 75; tail, 62; bill (long), 10, (broad), 8.

This is the most western representative of *vanikorensis*, which is distributed as far as Fiji and New Caledonia. The birds from the Solomon Islands (*ferrocyanea*) and Australia (*rubecula*) seem to be representatives, but considering the resemblance of some of the species of *Myiagra*, I do not dare to regard all of them subspecies of *rubecula*.

34. **Rhipidura rennelliana**, new species

TYPE.—No. 226459, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; May 16, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

DESCRIPTION.—Adult (male and female): crown and sides of the head chætura-drab (Ridgway XLVI); base of supraloral feathers white; back lighter and more brownish, about clove-brown (R. XL); rump lighter; feathers of chin and upper throat withish with gray bases; lower throat and sides of breast smoky hair-brown; feathers of the breast with grayish-brown centers and buff edges; feathers of the middle of the abdomen buff with grayish bases; under tail-coverts whitish or grayish buff; thighs smoke-gray; axillaries with gray bases and buff or whitish tips; under wing-coverts light gray; wing-feathers and coverts earth-brown; secondaries and coverts with narrow buff edges; upper tail-coverts and two central pairs of tail-feathers blackish brown; outer tail-feathers much lighter; shafts of the two outermost tail-feathers white, the next two light brown, the two central ones blackish brown; outer web of the outermost tail-feathers white; tip and lower edge of the four exterior tail-feathers white.

Juvenal: similar to adult, but edges of wing-coverts rusty, and the buff of the underside deeper, more cinnamon-buff.

Iris dark brown, bill blackish, lower mandible with whitish base, feet brownish gray. Bill, 10–11; tarsus, 20–22; weight 14–15 grs.

	WING	TAIL
6 ♂ ad.	76–85(81.7)	87–97(93.4)
2 ♀ ad.	77, 85	86, 96
4 imm.	71–78(73.2)	80, 81, 85

RANGE.—Rennell Island (collected Aug. 1928 and May 1930).

The May specimens are in fresh plumage, the August birds rather worn, one specimen already molting.

The relationship of this species to other Melanesian and Polynesian species of *Rhipidura* will be treated in a later paper.

35. **Pachycephala feminina**, new species

TYPE.—No. 226275, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island, August 30, 1928; H. Hamlin.

DESCRIPTION.—Male adult: crown brownish olive, sometimes more rusty, sometimes more olive; forehead, superciliary, postocular region, ear-coverts, and cheeks rusty; a collar across the hind-neck rusty olive; lores yellowish buff; circumocular feathers yellow; back dark olive; rump-feathers with yellowish olive tips; upper tail-coverts brownish olive; underside citron-yellow; throat paler; breast and flanks with an olive or rusty-olive tinge; under tail-coverts buffy yellow; axillaries white, washed with greenish yellow; carpal edge yellow; under wing-coverts white with gray centers; wing-feathers and coverts blackish brown with rust-colored edges; tail-feathers dark olive-brown.

Female adult: very similar to male, but usually duller above and underneath, the yellow of the underparts paler; often not distinguishable from males.

Juvenal: upper side much duller, more fuscous; crown sometimes quite rusty; the whole underside washed with rust-color.

Iris dark brown; bill yellowish brown; feet bluish; length of tarsus, 24–26, of bill (from nostril), 11–12, of culmen, 18 mm.; weight, 32 gr.

	WING	TAIL
♂ ad.	82–93(86.3)	52–62(56)
♀ ad.	81–90(84.9)	52–57(54.4)
imm.	78–87(82.3)	51–57(54.4)

RANGE.—Rennell Island (collected Aug. 1928 and May 1930).

This species belongs undoubtedly to the superspecies *Pachycephala pectoralis*, which has representatives east and west of Rennell Island. *P. feminina* is rather similar to the females of the Solomon Islands and Santa Cruz Islands thickheads. It even combines characters of both. But the most extraordinary fact is, that in *feminina* there is no sexual dimorphism which is so significant in the other members of the *pectoralis* group.

We have no experimental evidence to explain the interesting coloration of the males of *Pachycephala feminina*. The only way we can come to an explanation is to compare this case with similar cases in birds which have already received a genetic or experimental interpretation.[1]

To start from a general basis we must know what our present ideas are on the factors that produce the male coloration in birds. We assume that the secondary sexual characters of the male are directly produced by the genetic composition. The female has this same genetic composition with an additional factor which through an ovarian secretion suppresses the male appearance. If the ovary is excised the female acquires a plumage similar to that of the male.

Castration in normal males does not change the secondary sexual characters to a great extent; the main pattern of coloration remains unchanged. It is therefore more difficult to explain why males, in species with decided sexual dimorphism, sometimes acquire a female plumage.

There are certain breeds of domestic fowl, as for example the Sebright bantams, in which all the males have a hen-feathered plumage. Experiments with them have had the following results[2]: crossing with other strains (of normal coloration) showed that the factor for hen-feathered plumage was produced by two dominant genes.

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[1] See R. Goldschmidt, 1931, 'Die Sexuellen Zwischenstufen,' Berlin pp. 285–318, and pp. 475–479.

[2] T. H. Morgan. 'The genetic and operative evidence relating to secondary sexual characters.' Washington, 1919.

Castration, on the other hand, gave the somewhat unexpected result of changing the plumage in the direction of a decided sexual dimorphism. This points to a hormonal influence exercised by the testes, which results in suppressing the normal sexual dimorphism.

The probable interpretation of these experiments would therefore be that, in these hen-feathered races, there is a dominant gene which makes the feather-follicles react aberrantly to the hormones of the testes.

It would be interesting to collect more cases in birds similar to that of *Pachycephala feminina.* I just recall *Amblyornis inornatus* with its hen-feathered subspecies *inornatus* in the northwest of New Guinea and its sexually dimorphic races in central and eastern New Guinea. Murphy and Chapin[1] discussed the hen-feathered plumage of the males of the Azorian bullfinch.

To a similar category belong the cases of many birds with a double molt. Take, for example, many species of ducks and shore birds, which show a marked sexual dimorphism in one season (spring plumage) and a very slight dimorphism in another season (fall plumage). What is the hormonal basis of this phenomenon? We know by experiment that it is caused by an annual hormonal rhythm, but the knowledge of how this rhythm is connected with the physiology and how it is influenced by other internal and external influences is still undetermined. Here is a wide field for experimental work.

36. **Myzomela cardinalis sanfordi,** new subspecies

TYPE.—No. 226534, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island, May 22, 1930; H. Hamlin; W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Similar to *Myzomela cardinalis pulcherrima* Ramsay, but reddish parts scarlet, not scarlet-red (Ridgway I); scarlet tips on the black feathers of crown and throat much shorter and less brilliant; lower flanks scarlet, not black; even the black under tail-coverts in some specimens with red tips; smaller.

DESCRIPTION.—Male adult: head (except anterior edge of forehead, lores, and chin), hindneck, middle of back, rump, upper tail-coverts, throat, breast, and flanks scarlet; anterior edge of forehead, lores, chin, scapulars, upper and under wing-coverts, axillaries, wings, thighs, middle of belly, undertail-coverts and tail black; the edges of the primaries dusky olive.

Female adult: very different from the females of *pulcherrima* Ramsay and *sanctæcrucis* Sarasin; head, hindneck, ear-coverts, throat, and upper breast scarlet as in male, but the bases of the feathers dark olive-gray, not black; back and scapulars fuscous olive, some feathers with a reddish tinge, but without red tips as in *pulcherrima* and *sanctæcrucis;* upper tail-coverts red; upper wing-coverts, wing- and tail-feathers earth-brown with yellowish-olive edges; breast yellowish olive with reddish feather-tips; belly olive-buff; sides of breast and flanks gray with light olive feather-tips; axillaries, under wing-coverts, and inner edges of wing-feathers white.

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[1] 1929, Amer. Mus. Novitates, No. 384, p. 20.

Male juvenal: similar to the adult female, but upper side dull smoky olive, with scattered reddish feather-tips; upper tail-coverts red; ear-coverts, throat, breast, and flanks with reddish feather-tips.

Iris light brown; bill and feet black; tarsus, 22; bill (from nostril) 12.5–13; culmen, 17 mm.

	WING	TAIL	WEIGHT
♂ ad.	70–74(72.2)	44–47(45.4)	16–23(19.3)
♀ ad.	62–65(63.6)	39–41(40.2)	13
♂ juv.	68, 69	43, 45	15

RANGE.—Rennell Island (collected Aug. 1928 and May 1930).

It is a pleasure to name this beautiful bird in honor of Dr. L. C. Sanford, who showed so much interest in the exploration of Rennell Island.

The form *sanfordi* is a subspecies of the widespread *cardinalis*, which reaches from the New Hebrides (*cardinalis*) to New Caledonia in the south (*caledonica*), Rotuma Island (*chermesina*) and Samoa (*nigriventris*) in the east, San Cristobal Island (*pulcherrima*) in the west, and the Caroline Islands (*rubatra*) in the north. Closely related to this species are the Australian species *dibapha* and *erythrocephala* and some other species of the Papuan Region, the Moluccas, Lesser Sunda Islands, and Celebes.

37. **Zosterops rennelliana** Murphy

Zosterops rennelliana MURPHY, 1929, Amer. Mus. Novitates, No. 365, p. 10.

Zosterops griseitincta rennelliana, STRESEMANN, 1931, Mitt. Zool. Mus. Berlin, XVII, p. 225.

Murphy has already reported on the birds taken during the first visit. During the second visit (May 16–28, 1930) the expedition took specimens with the following measurements:

	WING	TAIL	WEIGHT
8 ♂	61–66(63.4)	41–43(41.7)	12–17(15)
6 ♀	62–64(63)	41–42(41.7)	14–15(14.3)

Stresemann considers *rennelliana* a subspecies of *griseotincta* in his recent revision of the genus. There is no doubt that *rennelliana* is related to *griseotincta*, but the relationship to the species *rendovæ* seems to be just as close or even closer. On the other hand, *rennelliana* differs from *griseotincta* (of which I have series of most of the subspecies) by several characters. But the bird from Nissan Island (*eichhorni*) is somewhat intermediate. However, even *eichhorni* has a well-developed eye-ring which seems to be a substantial character of THIS species. Besides that, *rennelliana* is characterized by the different shape of the bill, the entirely yellow feet, and the structure of the plumage which is intermediate between the soft one of the Louisiade Archipelago species (*griseotincta*, *aignani*, and *pallidipes*) and the strong, almost shiny plumage of *eichhorni*. As there is no other species of Rennell birds which has a similar distribution to *Zosterops griseotincta* in Stresemann's arrangement, and as there are undoubtedly some characters (as mentioned above) which distinguish the Rennell white-eye from the other ones, I prefer for the present to keep *Z. rennelliana* as a distinct species. Possibly it is quite closely related to *rendovæ*.

38. **Woodfordia superciliosa** North

Woodfordia superciliosa NORTH, 1906, Victorian Naturalist, XXIII, p. 104, Pl. VIII (Rennell Island). MURPHY, 1929, Amer. Mus. Novitates, No. 365, p. 10.

Iris light brown; bill greenish brown; feet bluish.

Only 5 specimens of this interesting species were taken by the expedition during its second visit, which have the following measurements:

	WING	TAIL	WEIGHT
1 ♂	77	47	28
4 ♀	75–81(77.1)	47–50(48.8)	23–36(29.2)

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NEW AMERICAN ASILIDÆ (DIPTERA). II[1]

BY C. H. CURRAN

Among the Diptera received for identification during the past few months were a number of undescribed Asilidæ, and these, together with some new forms in the Museum collection, are the basis of the present paper. The small collection made by Dr. F. Campos in Ecuador is particularly interesting and contains some unusual forms, while Mr. R. D. Bird secured many fine species in Oklahoma. Some of the new species contained in the Oklahoma collection are not dealt with in this contribution but will be described by Mr. S. W. Bromley.

The types of the new species are in The American Museum of Natural History.

SAROPOGON Loew

Material belonging to this genus, received since the publication of the key to the Nearctic species in American Museum Novitates No. 425, calls for a revision of that key. The following is presented in order to bring the key up to date.

TABLE OF SPECIES

1.—Scutellum with normally long bristles.................................4.
    Scutellum without long bristles; they are not more than half as long as the scutellum.................................2.
2.—Abdomen metallic bluish.......................... *pulcherrima* Williston.
    Abdomen black or reddish.................................3.
3.—Disc of scutellum bare; four short black marginal bristles... *aridus* Curran.
    Disc of scutellum with short hairs........................ *abbreviatus* Johnson.
4.—Abdomen black.................................5.
    Abdomen mostly reddish.................................9.
5.—Bristles of the coxæ black.................................6.
    Bristles of the coxæ white or yellow.................................7.
6.—Scutellum with two black bristles........................ *purus* Curran.
    Scutellum with four whitish-yellow bristles................ *combustus* Loew.
7.—Antennæ black.. *combustus* Loew.
    Antennæ reddish except the style.................................8.

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[1] See American Museum Novitates No. 425 for paper No. 1.

8.—Scutellum with four bristles .... *dispar* Coquillett.
Scutellum with two bristles .... *birdi*, n. sp.
9.—Venter black .... 10.
Venter reddish on more than the basal half .... 13.
10.—Wings brownish or blackish .... 11.
Wings hyaline .... *coquilletti* Back.
11.—Femora without black vitta above .... 12.
Femora with broad black vitta above .... *dispar* Coquillett.
12.—Scutellum with two bristles .... *purus* Curran.
Scutellum with four bristles .... *combustus* Loew.
13.—Wings entirely hyaline .... 14.
Wings brown along the veins .... *luteus* Coquillett.
14.—Mesonotum gray pollinose .... *semiustus* Coquillett.
Mesonotum yellowish-gray pollinose, with three brown vittæ.
hyalinus Coquillett.

Saropogon combustus Loew

LOEW, 1874, Berl. Ent. Zeit., p. 373.

A female, Woods Co., Okla., July 16, collected by Mr. R. D. Bird, agrees with a male taken at the same time in having black antennæ, palpi, and wings. The legs are reddish, their coxæ with yellowish bristles. This form differs so strikingly from the reddish form described as *adustus* by Loew that the two appear to represent distinct species. However, if such is the case the males are evidently so similar in every way that they will be very difficult to separate unless the male of *adustus* is still unknown. This seems unlikely, since the red form has been frequently taken at the same time as the black males. I am not aware of any previous record of the female form with the black abdomen.

Saropogon dispar Coquillett

COQUILLETT, 1902, Journ. N. Y. Ent. Soc., X, p. 139.

A female, Osage Co., Okla., July 22, 1929 (Bird), has the abdomen black and the femora, palpi, and antennæ wholly reddish.

Saropogon birdi, new species

Related to *dispar* Coquillett but distinguished by the presence of only one pair of scutellar bristles, black basal segments of the palpi, etc. Length, about 27 mm.

FEMALE.—Head black, yellow pollinose, the posterior orbits white pollinose; face and lower border of the front reddish in ground color; bristles wholly pale yellowish. Apical segment of the palpi and the base of the proboscis reddish. Antennæ reddish, the style black.

Thorax blackish; mesonotum reddish, with three broad, narrowly separated blackish vittæ, the outer ones abbreviated in front, the median one behind; pronotum and postnotum reddish. Bristles yellowish. Pleura with rather golden pollen, the mesonotum stained but obviously clothed with yellow pollen. Scutellum reddish, flat, with one pair of bristles and without hair.

Coxæ and posterior trochanters black, the anterior coxæ reddish anteriorly and thickly yellow pollinose. Legs reddish, the femora blackish above on most of their length, the posterior pair black on the sub-basal third of the ventral surface; bristles pale yellowish.

Wings rather amber-colored, the apex very broadly infuscated; fourth posterior cell broadly open. Halteres reddish.

Abdomen shining black, the second, third and fourth segments each with a subtriangular, transverse whitish pollinose spot on either side of the posterior margin, the ground color beneath obscurely reddish. Hair black; yellowish on the first segment and the broad sides of the second and third.

TYPE.—Female, Johnston Co., Okla., June 20, 1929 (R. D. Bird).

LESTOMYIA Williston

This genus was established by Williston[1] in 1883 with *Clavator sabulonum* Osten Sacken as the type species. At the same time Williston described *L. fraudiger*. Both species have been recorded from California and *sabulonum* from Oregon. I have not seen *fraudiger*, but there are specimens of *sabulonum* before me collected by Dr. Lutz in Wyoming in 1920. A second species from Wyoming is undescribed.

TABLE OF SPECIES

1.—Posterior femora black except at the base and apex; at most the base of the first antennal segment reddish .... 2.

Posterior femora red except on the dorsal surface; basal two segments of the antennæ reddish yellow .... *strigipes*, n. sp.

2.—Anterior femora with a small black ring .... *fraudiger* Williston.

Anterior femora with the narrow base and the apical fourth, or slightly more, reddish .... *sabulonum* Osten Sacken.

Lestomyia strigipes, new species

Readily distinguished from the described species by the color of the legs and the wholly yellowish basal antennal segments. Length, 9.5 to 12 mm.

MALE.—Head black in ground color, with whitish hair and yellowish-white bristles; pollen whitish, that on the front with a yellowish tinge. Antennæ situated slightly nearer to the oral margin than to the top of the ocellar tubercle. Palpi and proboscis shining black, white-haired. Antennæ reddish, the third segment black, the second with a brown tip, a little shorter than the first; third segment increasing in width from the basal fourth, at its widest point about twice as wide as near the base; style small, obtuse. Cheeks shining black in the middle.

Thorax cinereous-yellow pollinose, somewhat brassy, the pleura more whitish except in the middle. Mesonotum with a pair of narrow median brownish vittæ, the outer vittæ obscure and only visible in some lights. Hair and bristles yellowish, the pleura practically bare except for the trichostical hairs. Prosternum bare. Scutellum flat, with three or four pairs of yellow marginal bristles, otherwise bare.

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[1] Trans. Amer. Ent. Soc., XI, p. 19.

Legs reddish; coxæ brown at the base, cinereous pollinose; all the femora broadly black above, without pollen; tibiæ black or ferruginous above, the tarsi black or ferruginous. Hair very pale yellowish, white on the coxæ; bristles yellow.

Wings hyaline, the veins brown; fourth posterior cell broadly open; anal cell open or closed in the wing margin. Halteres yellow.

Abdomen black in ground color, the sides and apical segments reddish or mostly so, thickly cinereous-yellow pollinose, each segment with an oval, shining black spot in the middle, the third and fourth with a more or less distinct oval, bare spot toward either side in the middle. Venter brown and reddish, thickly pollinose. Hair and the bristles on the sides of the first segment yellowish. Genitalia shining red, the hair mostly whitish.

FEMALE.—Sixth to eighth abdominal segments shining dark reddish.

TYPES.—Holotype, male, allotype, female, male and female paratypes, Pine Bluffs, Wyoming, June 9, 1920 (F. E. Lutz).

COPHURA Osten Sacken

The type of this genus is *sodalis* Osten Sacken, of which I have not seen specimens. From the description given by Osten Sacken it is apparent that most of the species placed in the genus belong elsewhere and in 1925 I erected the genus *Buckellia* (Can. Ent., LVII, p. 156) for *Cophura albosetosa* Hine. Several North American species belong to *Buckellia*, but I am not sure just where the line should be drawn and, until I have studied the genotype, do not feel competent to render an opinion. I think that the species I am describing herein as *C. panamensis* is a species of *Cophura* in the strict sense, since the upper half of the face is without trace of hairs. In addition to this the face gradually widens from the antennæ to the lower part of the eyes. If this character is present in *sodalis* the limits of *Cophura* may be well defined and the genus would then probably include *humilis* Williston and *bella* Loew. In the other species I have seen, the face is only a little wider below than at the antennæ and it bears two longitudinal, single or double rows of hairs above the mystax. In typical *Buckellia* the face is gently convex, but in other species it is flattened on the upper half.

For convenience I have placed all the species in *Cophura* and included them in a key. Most of the species are known to me only from description and I have used Melander's key (Psyche, XXX, pp. 208, 209) as a basis.

Table of Species

1.—Abdomen more or less reddish, sometimes wholly red or with the sides or apical segments or the apices of the segments reddish; abdomen rather broad....2.
Abdomen wholly black in ground color..........5.
2.—Abdomen red or reddish yellow..........3.
Abdomen mostly black, the apices of the segments or lateral margins or apical segments reddish..........4.
3.—Mesonotal stripes brownish..........*bella* Loew.
Mesonotal vittæ deep black..........*sodalis* Osten Sacken.
4.—Apices of the abdominal segments reddish; femora black, their apices and the broad bases of the tibiæ yellow..........*humilis* Williston.
Apical one or two abdominal segments and usually the broad lateral margins reddish; legs dark reddish or ferruginous..........*panamensis*, n. sp.
5.—Abdomen wholly pollinose on the first five segments..........6.
Abdomen more or less extensively black on the second and following segments..........9.
6.—Tarsal segments yellow basally; anal cell closed and short petiolate. *clausa* Coquillett.
Tarsi black..........7.
7.—Antennal style almost twice as long as the second antennal segment (Oklahoma). *stylosa*, n. sp.
Antennal style equal in length to the second antennal segment..........8.
8.—Scutellum with one pair of marginal bristles (Arizona)....*pollinosa* Curran.
Scutellum with three pairs of marginal bristles (Colorado).....*lutzi*, n. sp.
9.—Anterior border of the abdominal segments pale pollinose..........10.
Segments not pollinose anteriorly, the pollen limited to the sides and posterior borders..........12.
10.—Pollen on the sides of each segment enclosing a shining black spot or separated from a posterior pollinose spot..........17.
Pollen not enclosing black spot..........11.
11.—Anal cell closed and petiolate..........*clausa* Coquillett.
Anal cell open..........*trunca* Coquillett.
12.—Legs entirely black..........14.
At least the tibiæ mostly reddish..........13.
13.—Femora black..........*Buckellia vitripennis* Curran.
Legs brownish red..........*brevicornis* Williston.
14.—Oral bristles black..........*scitula* Williston.
Oral bristles whitish..........15.
15.—Mesonotum with conspicuous erect hair..........16.
Mesonotum nearly bare..........*fur* Williston.
16.—Hair and bristles of the mesonotum brownish or brownish yellow; wings faintly tinged with brown..........*pulchella* Williston.
Hair and bristles whitish; wings pure hyaline......*Buckellia albosetosa* Hine.
17.—Pollen on the front of the segments not connected with that on the posterior corners..........*melanochaeta* Melander.
Pollen on the sides of the segments enclosing a black spot...*highlandica* Cole.

Cophura panamensis, new species

Black, the sides of the abdomen and apical two segments reddish; legs dark reddish; wings largely brownish. Length, 8 to 12 mm.

FEMALE.—Head grayish-white pollinose, the front bare and shining black except on the anterior border. Face, cheeks and frontal orbits reddish in ground color. The whitish mystax extends from orbit to orbit and occupies a little more than the lowest third of the face, the upper part flat and bare, the lower part slightly produced but receding below; the face widens from the level of the antennæ to below the eyes. Front slightly narrowed above, with several obscure pale hairs on either side; ocellar tubercle with five or six coarse brown hairs on either side. Occiput, palpi and proboscis with pale yellowish hair; palpi and proboscis brownish red to blackish. Antennæ reddish or brownish red, the third segment black above and apically, the basal segments sometimes blackish above; the hair mostly pale yellowish, but there are a few black bristly hairs; third segment longer than the basal two combined, narrow on the basal fifth, widest beyond the middle, usually with one or two black hairs above; style short and rather thick, not longer than the basal width of the third antennal segment, the basal half blackish, the apex reddish yellow.

Thorax ferruginous in ground color, yellowish-brown pollinose, the metanotum black behind. The mesonotal vittæ are brown, the median one divided by a yellowish line, evanescent posteriorly. Hair coarse, black, the bristles either black or yellowish; the vittæ bare. Pleura with pale, fine hair, the trichostical bristles numerous, mostly black.

Legs ferruginous or brownish red, the posterior femora black on the lowest third; coxæ with brownish pollen, the anterior pair on the basal third and the posterior pair on the outer side bare, the hair and bristles yellow, mostly black on the anterior pair. Hair and bristles of the legs black, the femora with a few yellow hairs dorsally on the basal third.

Wings pale brownish yellow, brown in front to beyond the middle where the dark color extends over the cross-veins and forms clouds on the cross-veins and furcations on the apical part of the wing; basal cells of a paler brown; anterior branch of the third vein without an appendage. Fourth posterior cell very broadly open apically. the anal cell narrowly open. Halteres dull reddish-yellow.

Abdomen shining black, the lateral margins broadly dark red, sometimes only partly so, the seventh and eighth segments dark red. Base and sides of the first segment and basal sternite brownish pollinose, the venter shining dark reddish. Hair pale yellowish, very short and inconspicuous on the dorsum, longer on the sides, venter and genitalia.

TYPES.—Holotype, female, Barro Colorado Island, Canal Zone, January 25, 1929; paratype, female, Barro Colorado, February 21, 1929 (Curran).

This species has the abdomen almost parallel-sided on the basal three-fourths and, like *sodalis* Osten Sacken and *humilis* Williston, has the abdomen very shining. It most nearly approaches *humilis* but has differently colored legs and more extensively brown wings.

Cophura stylosa, new species

Black, with cinereous-yellow and dull ochreous pollen, the abdomen almost wholly pollinose; tibiæ reddish yellow. Length, 11.5 mm.

FEMALE.—Head ochreous pollinose, the occiput grayish: mystax composed of about three confused rows of pale yellowish bristles above the oral margin; face flat above, with a double row of pale hairs on either side; front with three or four pale hairs on either side; one pair of bristles on the ocellar tubercle and a few hairs. Bristles of the occiput yellowish, the hair white. Palpi and proboscis black, white-haired. Antennæ black, thinly pale pollinose, with pale hair and bristles; third segment longer than the basal two segments combined, tapering on its apical third, style as long as the first two segments.

Thorax densely grayish-ochreous pollinose, the hair and bristles pale yellowish; mesonotum with three broad, shining black vittæ, the hair sparse and fine. The mesonotum may normally be wholly pollinose although it does not appear to be much rubbed, the fine hair being present. Scutellum concolorous with the mesonotum, wholly pollinose, bare except for the single pair of strong marginal bristles.

Legs black, the tibiæ reddish yellow with black apices; femora with obscure reddish apex; hair and bristles wholly yellowish. Coxæ grayish-yellow pollinose.

Wings hyaline, tinged with brownish on the apical half; anterior branch of third vein without basal appendage. Squamæ and halteres yellow, the latter with black

Abdomen black in ground color, densely cinereous pollinose, the dorsum more or less ochreous, the sixth segment above, except the sides, and the seventh segment wholly, shining black, the apices of the fifth tergite and sixth sternite also shining except at the sides. Hair very short, pale yellowish, a little longer on the venter.

TYPE.—Female, Woods Co., Oklahoma, July 1, 1930 (R. D. Bird).

Differs from *pollinosa* Curran by the much longer antennal style.

Cophura lutzi, new species

Very similar to *pollinosa* Curran but the scutellum bears six marginal bristles instead of two. Length, 7.5 mm.

MALE.—Head black in ground color, cinereous-white pollinose, the vertex tinged with yellow; hair and bristles white. Mystax composed of a row of fine oral bristles and rather sparse hair. Proboscis and palpi shining black. Antennæ black, brown pollinose; first and second antennal segments of about equal length, the third longer than the basal two combined, tapering on the apical third; style slightly longer than the second segment.

Thorax cinereous pollinose, the mesonotal vittæ brown. Hair and bristles yellowish, the pleural hair white. Scutellum bare except for the six marginal bristles.

Legs black, the coxæ cinereous pollinose, the tibiæ reddish yellow on the basal three-fourths. Hair and bristles whitish.

Wings hyaline, the veins brown. Halteres reddish yellow.

Abdomen cinereous pollinose, the dorsum cinereous brown. Hair yellow, whitish on the sides and venter. Genitalia shining brown.

TYPE.—Male, Regnier, Colorado, June 6–9, 1919 (F. E. Lutz).

Of the three species with wholly pollinose abdomen, *pollinosa* Curran bears only two rows of long bristly hairs beneath the femora and short hair in addition, while both *stylosa* and *lutzi* bear erect and fairly long hair between the rows of bristly hairs. *C. stylosa* has the femora more strongly haired beneath than *lutzi* and the middle femora display distinct bristles but these are not developed in *lutzi*.

PSILOCURUS Loew

Dr. Campos forwarded a single male of this rather rare genus collected in Ecuador, and Mr. Bird collected three specimens in Oklahoma, each securing species apparently undescribed. All the species resemble each other and, as has been pointed out by both Loew and Williston, bear a rather close resemblance to species of *Laphystia* Loew. Despite the open marginal cell these two genera are related to *Atomosia* and I agree with Williston that they belong in the Laphriinæ rather than in the Dasypogoninæ. I have seen none of the described species, so the following key is based upon descriptions.

TABLE OF SPECIES

1.—Scutellum with two marginal bristles. . . . . .2.
Scutellum with four marginal bristles. . . . . .3.
2.—First antennal segment mostly yellow (Texas). . . . .*nudiusculus* Loew.
Antennæ wholly black (Mexico). . . . .*caudatus* Williston.
3.—Tomentum of the mesonotum black on the disc except along the suture; outer pair of scutellar bristles as long as the inner, which are not erect. *camposi*, n. sp.
Tomentum of the mesonotum mostly golden; median pair of scutellar bristles erect and stronger than the outer pair . . . . .4.
4.—Femora red beneath, the base of the tibiæ yellow. . . . .*birdi*, n. sp.
Legs wholly black (South Dakota). . . . .*modestus* Williston.

Psilocurus camposi, new species

Black, with cinereous pollen; halteres, trochanters, tips of the femora and a broad posteroventral stripe on the anterior femora reddish. Length, 9.5 mm.

MALE.—Head yellowish-cinereous pollinose, the occiput rather silvery; hair and bristles whitish, the front with several fine, short black bristles on either side, the occiput with three black bristles on either side above. Palpi and proboscis black, the hair pale. Antennæ black, the first segment with pale yellowish, the second with black hair, the first with a long, pale bristle below; third segment about as long as the first two combined, oval, rather pointed apically.

Thorax with cinereous pollen. Mesonotum shining black, its sides and posterior border pale pollinose; sides and broad anterior border with very short, appressed golden hair, the disc with appressed black hair, some of which has a golden tinge in some lights. Scutellum shining black, with short, appressed black hair, the base with rather golden hair; four pairs of equally strong marginal bristles. Pleura with whitish pile, some of the trichostical bristles black. Mesonotal slopes bare.

Legs black; trochanters and tips of the femora reddish, the anterior femora broadly reddish on the posteroventral surface. Hair silvery white, black on the upper surface of the posterior femora, the apical half of their tibiæ dorsally and the upper surface of their tarsi. Middle tibiæ with two black bristles in front, the posterior legs with the dorsal bristles black; hair rather long posteriorly on the anterior four tibiæ.

Wings cinereous hyaline; anterior branch of third vein arising at almost a right angle, without appendage. Halteres reddish.

Abdomen rather dull black, the apical segment metallic greenish-black. Second to sixth segments with a large, transverse cinereous triangle on the posterior corners, the pollinose spots broadly separated in the middle; first segment almost wholly pale pollinose, the seventh with a small spot behind. Hair very short and appressed, black, the pollinose areas with white hair; second to fifth segments each with two or three whitish bristles on either side. Genitalia ferruginous, the appendages black; hair black, the outer lamellæ with abundant white hair on their apices, the globular basal portion with a strong tuft of black hair near the middle on either side. Venter black, the hair mostly black.

TYPE.—Male, Guayaquil, Ecuador (F. Campos).

Psilocurus birdi, new species

Black, with cinereous pollen, the legs and abdomen partly reddish, the abdomen variable in color. Length, 9 to 9.5 mm.

FEMALE.—Head black in ground color, the pollen brownish, the broad facial and occipital orbits whitish. Hair and bristles yellow, the occipital cilia mostly black. Face swollen on slightly less than the lower half, the mystax composed almost entirely of bristles; a row of short hairs on either side of the face above the mystax. Proboscis black, pale-haired; palpi black, black-haired. Antennæ black, the first two segments clothed with black hair and bristles; third segment twice as long as wide, rather tapering from near the base, the brown sensory area covering most of the inner surface.

Mesonotum and scutellum thickly clothed with appressed, golden, tomentum-like pile, the median dark vittæ obscure, the sides gray pollinose behind the suture. Scutellum with four strong marginal bristles. Pleura cinereous pollinose, the mesopleura more brownish. Pleural pile short, whitish, the trichostical bristles mostly black.

Legs black; coxæ with whitish pollen and hair. Femora broadly reddish beneath; their apices and the broad bases of the tibiæ yellowish. Hair whitish, silvery white dorsally on the anterior four tibiæ and tarsi, mostly black above on the posterior tibiæ and tarsi. Bristles yellowish, black on the femora and on the upper surface of the posterior tarsi.

Wings cinereous hyaline; base of the anterior branch of the third vein with or without trace of an appendage in front. Squamæ and halteres reddish yellow.

Abdomen black, slightly shining, the apical four or five segments sometimes dark brownish-red, or reddish beneath the pollinose spots; very variable. Sides of third to seventh segments with a large, transverse whitish pollinose triangle behind, the apex of each segment more or less narrowly whitish pollinose, thus forming entire fasciæ which may or may not be distinct; sides of the first and second segments pollinose on their whole length, the pollinose spots on the second segment subrectangular. Hair very short, black on the black portions, white on the pollinose areas. Venter grayish-brown pollinose, the base pale-haired, the remainder with mixed whitish and black hair.

TYPES.—Holotype, female, Sequoyah Co., Oklahoma, July 7, 1929; paratypes, two females, Ottawa Co., Oklahoma, July 20, 1929 (R. D. Bird). One paratype will be deposited in the United States National Museum and one in the University of Oklahoma.

In his work on the North American Dasypogoninæ, Back states that the scutellum of *nudiusculus* Loew sometimes bears four bristles. Such specimens may be distinguished from *birdi* by their yellowish tibiæ and first antennal segment.

LAPHYSTIA Loew

In 1927 (Can. Ent., LIX, pp. 85–87), I presented a key to the described species of *Laphystia* occurring in North America and suggested some obvious synonymy. Since that time I have seen a considerable amount of additional material and a further review of the species seems desirable at the present time. In order that the species may be the more readily identified I have prepared notes on the described species, except the two described in the paper above mentioned, and have enlarged the key to include all the species in the collection of the Museum.

In the Aldrich catalogue of Diptera (1904) two species are placed in the genus *Laphystia*, one of them with a query. In 1904, Coquillett recognized four species, two of which were wrongly determined. The synonymy given in the Aldrich catalogue under *sexfasciata* Say is incorrect, at least in regard to the references of Bigot and Williston. The synonymy of his *notata* with *sexfasciata* Say was published by Bigot himself, but at the suggestion of Osten Sacken, and it was that publication which led to the confusion which followed. In the Nearctic material before me I recognize nine species and have two additional ones from South America. Both of the Neotropical species show some rather marked differences in comparison with the Nearctic examples, but it seems to me that they should be grouped with them and I have not proposed new generic names, since I consider them to be nothing more than aberrant forms.

In order to determine the exact position of *Triclis notata* Bigot I wrote to Mr. J. E. Collin, believing the type to be in his collection, and have received the following information.

"Bigot's types of Asilidæ are no longer in my possession. I gave them to the Hope Museum, Oxford, before the war. I have written to Oxford about the type of *Laphystia* (*Triclis*) *notata* Bigot but it cannot be found. I have no doubt that as Bigot himself sank it as a synonym of *sexfasciata* he placed the type under that species AFTER CAREFULLY REMOVING ALL LABELS THAT WOULD HAVE IDENTIFIED THE SPECIMENS for that was his custom. It would appear necessary to accept his synonymy."

It is most unfortunate that the labels were removed from the specimen, but at the same time the synonymy cannot be accepted since Bigot's species is without question different from *sexfasciata* Say. I have identified as *notatus* the species which seems to agree best with Bigot's description.

Table of Species

1.—Femora not wholly reddish.................2.
Femora wholly reddish...............*confusa* Curran.
2.—Posterior femora reddish on the basal half or more..........3.
Posterior femora reddish on less than the basal third..........5.
3.—Pollinose bands on at least the second and third abdominal segment entire or practically so, at most very narrowly interrupted..........11.
Pollinose bands interrupted by at least the length of one spot..........4.
4.—Middle femora black with the basal fourth and apex reddish....*notata* Bigot.
Middle femora reddish with the apical fourth black..........*varipes*, n. sp.
5.—All the abdominal segments with entire pollinose cross-bands..........6.
Pollinose bands on the fourth and fifth segments interrupted or the abdomen golden pollinose..........7.
6.—Mesonotum clothed with erect hair on the whole surface..........13.
Mesonotum bare except in front of the scutellum..........*scalaris* Hermann.
7.—Abdomen golden pollinose; robust species..........*salti*, n. sp.
Abdomen with cinereous pollinose spots..........8.
8.—Erect mesonotal hair rather abundant and conspicuous.......... 10.
Erect mesonotal hair sparse or mostly wanting..........9.
9.—Dorsum of the abdomen mostly red on the apical half.. .. *rufiventris*, n. sp.
Abdomen wholly black..........12.
10.—Mesonotum with an area of appressed, shorter hair behind the suture on either side; abdominal fasciæ always very broadly interrupted; femora pollinose above..........*canadensis* Curran.
Mesonotal hair all erect or suberect, more abundant; bands on the second and third segments usually entire, at most narrowly interrupted; femora without pollen..........*litoralis*, n. sp.
11.—Abdomen reddish on the apical half at least beneath the pollinose spots....14.
Abdomen black in ground color.......... *sexfasciata* Say.
12.—Middle femora conspicuously reddish at the base.......... *notata* Bigot.
Middle femora wholly black basally..........*ochreifrons*, n. sp.

13.—The abdominal pollen leaves only a black triangle in the middle on the bases of the third to seventh segments ....*opaca* Coquillett.

The third to seventh segments are each shining black on the basal half except laterally...... ....*texensis*, n. sp.

14.—Abdomen brownish red on more than the apical half, not paler beneath the pollinose fasciæ. . ...*limatula* Coquillett.

Abdomen black, pale reddish beneath the pollinose fasciæ..*rufofasciata*, n. sp.

Laphystia sexfasciata Say

Dasypogon sexfasciata SAY, 1823, Journ. Acad. Nat. Sci. Phila., III, p. 50.

Black with cinereous pollen, the abdominal fasciæ entire; legs partly reddish. Length, 9 to 10.5 mm.

MALE.—Head cinereous-white, the hair and bristles wholly white. Palpi and proboscis black. Antennæ black; third segment about equal in length to the basal two combined, the style short and broad.

Thorax cinereous pollinose, with yellowish tinge on the dorsum. Hair white, the short appressed hair on the mesonotum and the bristles yellowish tinged. Narrow apex of the scutellum shining black.

Coxæ black, cinereous-white pollinose and white haired. Anterior femora black, the base obscurely reddish; middle femora reddish with the apical third black, the posterior pair reddish with the apical fourth black; tips of all the femora reddish; black portions of the femora pale pollinose, the reddish portions without pollen. Tibiæ and tarsi black, the tibiæ reddish on the basal third or less. Hair and bristles whitish.

Wings hyaline, the veins brown apically, yellowish on the basal half; first posterior cell not narrowed at the apex; anal cell closed just before the margin of the wing. Halteres reddish yellow.

Abdomen shining black, the lateral margins and the apices of the segments cinereous pollinose, the bands more or less widened medianly, the first and second segments almost wholly pollinose. Hair white. Genitalia shining black.

FEMALE.—Agrees in all respects.

The specimens before me are from Manitoba.

Laphystia limatula Coquillett

COQUILLETT, 1904, Proc. Ent. Soc. Wash., VI, p. 180.

The only specimen of *limatula* seen by me is the type in the United States National Museum. The species is rather similar to *rufofasciata*, new species but the ground color of more than the apical half of the abdomen is brownish red, somewhat darker at the sides, and there is no indication of paler fasciæ beneath the pollinose bands. All the femora are black on the apical half, at least on the upper surface. The pollinose abdominal fasciæ are at most obscurely interrupted in the middle.

The type is from New Mexico.

Laphystia rufofasciata, new species

Black, the fourth to seventh segments with reddish fasciæ beneath the pollinose bands. Length, 8.5 to 9 mm.

MALE.—Black, the head with whitish pollen and hair; third antennal segment a little longer than the basal two combined; style somewhat longer than wide; broad, its apex rounded.

Thorax cinereous pollinose, the mesonotum somewhat darker in the middle; hair white, very short and mostly golden or brassy yellow on the disc of the mesonotum, only a few of the hairs on the posterior part long. Scutellum cinereous pollinose, the tip shining, the hair very short and brassy-yellow.

Coxæ black, whitish pollinose and pilose; femora reddish, the anterior pair black dorsally, the posterior pair black on the upper half of the apical third; femora cinereous pollinose on upper half or less; tibiæ and tarsi black, the tibiæ reddish yellow on almost the basal half; legs with whitish hair and bristles, the hair mostly very short and appressed; anterior femora with three or four fine bristles below.

Wings cinereous hyaline; first posterior cell only slightly narrowed at the apex. Squamæ pale yellow; halteres reddish-yellow.

Abdomen black, the first and second segments, broad sides of the third to seventh, preapical fasciæ on the third to sixth, and the apical third of the seventh cinereous-white pollinose, the apex of the second segment shining except laterally, the pollinose fasciæ occupying almost half of the intermediate segments and more or less distinctly interrupted on the fifth and sixth segments; fourth to sixth segments each with a medianly interrupted reddish fascia beneath the pollinose bands, the seventh reddish on the apical third. Hair very short and golden brown on the dorsum, a little longer and pale brassy yellow on the sides and venter; bristles whitish yellow.

FEMALE.—Anterior femora brown only on the apical half of the upper surface, the middle and posterior pair brown only on the apical third or fourth. Third abdominal segment with transverse reddish spots on either side, the eighth and ovipositor wholly yellowish red.

TYPES.—Holotype, male, Green River, Wyoming, July 2, 1920; allotype, female, and one paratype, female, Rock Springs, Wyoming, June 29, 1920 (F. E. Lutz).

This species is close to *limatula* Coquillett but the black abdomen with sharply defined reddish fasciæ will distinguish it. It is also less robust than *limatula* and has less extensively dark femora.

Laphystia notata Bigot

Triclis notata BIGOT, 1878, Ann. Soc. Ent., Fr., p. 433.

Laphystia sexfasciata BIGOT, 1879, Bull. Soc. Ent. Fr., p. lxviii.

Black, the legs partly reddish; second to sixth abdominal segments with posterior whitish triangles on either side. Length, 9.5 to 10.5 mm.

MALE.—Head white pollinose and pilose, the occipital cilia and bristles on the antennæ yellowish. Proboscis and palpi shining black. Antennæ black, brownish-yellow pollinose, white-haired; second segment decidedly shorter than the first; third segment a little shorter or of about the same length as the first two combined; style short and wide.

Thorax black in ground color, whitish pollinose, the mesonotum with three more or less distinct darker vittæ. Hair of the mesonotum whitish, the disc with mostly appressed yellow, tomentum-like hair, in front of the suture on either side and in front of the scutellum, with sparse, erect hair. The pollen on the mesonotum and mesopleura may have a brassy yellow tinge, except on the sides of the former. Scutellum whitish or yellowish, with the usual fringe of fine white hair and some appressed hair on the disc.

Femora black, the posterior pair reddish on about the basal half, the others with the bases narrowly reddish, the tips of all the femora and almost the basal half of the tibiæ reddish yellow, the apical half of the tibiæ and the tarsi wholly, black. Coxæ and femora cinereous-white pollinose, the posterior femora bare on more than the ventral half. Hair white, the bristles pale yellowish.

Wings cinereous hyaline, often tinged with brown, the veins brown and more or less clearly bordered with the same color. First posterior cell widely open.

Abdomen shining black, the sides white pollinose, the pollen produced triangularly inward on the posterior half of the second to sixth segments, the broad apex of the seventh segment pollinose. Venter cinereous yellow. Pile whitish, the dorsum with very short, appressed black hair.

FEMALE.—Eighth and ninth abdominal segments whitish pollinose.

Two males and six females from Galveston, Texas, and one from Lawrence, Kansas.

Laphystia opaca Coquillett

COQUILLETT, 1904, Proc. Ent. Soc. Wash., VI, p. 180.

Rather similar to *texensis* new species but at once distinguished from all the described species by the unusually extensive cinereous-pollinose abdomen. On the middle of the second and following segments the pollen leaves almost equilateral shining black triangles which extend back only to the middle of each segment. The femora show scarcely a trace of reddish at the base and the tibiæ are only narrowly reddish basally, the tips of the femora reddish. In other respects the description of *texensis* will be found to agree. In *texensis* the pollen leaves very evident shining black fasciæ which vary somewhat in width.

The type, from Texas, in the United States National Museum, is the only specimen I have seen.

Laphystia texensis, new species

Black, the tips of the femora and bases of the tibiæ reddish; abdomen cinereous-white pollinose with shining black fasciæ on the bases of the third to seventh segments. Length, 9 to 11.5 mm.

MALE.—Head with white pollen, pile and antennal bristles. Third antennal segment with brownish pollen, narrowing from the middle to the apex; style a little longer than wide, rather truncate apically, with a small bristle in the outer depression,

Thorax cinereous pollinose, usually with brownish-yellow tinge dorsally and with indications of three dark vittæ. Pile whitish, abundant, moderately long, erect.

Legs black, tips of all the femora, the narrow base of the posterior pair and about the basal fifth of all the tibiæ, reddish. Coxæ whitish pollinose and pilose; apices of the femora with a little whitish pollen above. Hair and bristles whitish, the femora with moderately long hair except dorsally.

Wings hyaline; veins brown, yellowish basally; first posterior cell but little narrowed apically. Halteres yellow.

Abdomen cinereous-white pollinose, the second to seventh segments with incomplete shining black fasciæ on the basal half, the fasciæ broadest in the middle and narrowing toward either side; the tips of the second to sixth segments more or less distinctly shining on the median half. Hair and bristles whitish on the sides and venter, brassy yellow and quite short on the dorsum.

Female.—The shining black abdominal fasciæ are usually of almost equal width throughout and usually slightly wider than in the male; eighth segment wholly pollinose; genital segments black.

Types.—Holotype, male, allotype, female; two male and four female paratypes, all from Galveston, Texas, June 5, 1900 (W. M. Wheeler collection). Paratypes in the Canadian National Collection.

This species is readily distinguished from *sexfasciata* Say by the black femora and from *opaca* Coquillett by the transverse black fasciæ on the abdomen.

Laphystia varipes, new species

Black, the legs mostly reddish; abdomen sometimes reddish beneath the pollinose spots. Length, 11 to 11.5 mm.

Male.—Head white pollinose and pilose, the occipital bristles yellowish. Proboscis and palpi shining black. Antennæ black, first segment white pollinose, the others yellowish brown; third segment longer than the basal two combined; style short and wide.

Thorax black in ground color, whitish pollinose, the mesonotum with brownish-yellow pollen. Hair of the mesonotum yellowish or rather golden, appressed and very short except anteriorly and posteriorly. Pleural hair white, that on the scutellum yellow, short and appressed except on the apical margin.

Legs reddish, the coxæ, broad apices of the tibiæ and all the tarsi black, the femora black as follows; an incomplete apical band on the posterior pair, a broader apical band on the median pair and the front pair on almost their whole length except below, where the reddish color extends to the middle, the base broadly and the narrow apex reddish, the tips of the posterior four femora also reddish. Coxæ, anterior four femora and upper half of the posterior pair, whitish pollinose. Hair and bristles whitish.

Wings cinereous hyaline; first posterior cell closed on one wing, broadly open in the other. Halteres reddish yellow.

Abdomen shining black, the sides cinereous-white pollinose, the pollen produced as posterior triangles on segments three to six, the inner ends pointed and separated from each other by one-third the width of the abdomen, the seventh segment with the apex broadly pollinose.

Female.—Pollen of the face and front with a yellowish tinge; femora with less black, the posterior pair with only a blackish spot above, the middle pair black on the upper half of the apical fourth, the yellow color much more extensive on the lower part of the anterior pair. The ground color beneath the pollinose spots on the third and following segments is reddish and the wholly pollinose eighth and ninth segments are reddish in ground color. The female is somewhat teneral and fully developed specimens are probably similar to the male.

TYPES.—Holotype, male, and allotype, female, Cherokee, Oklahoma, Salt Plains, June 16, 1930 (R. D. Bird).

Laphystia ochreifrons, new species

Black, the tips of the femora and the broad bases of the tibiæ reddish, the base of the posterior femora narrowly reddish. Length, 11 mm.

FEMALE.—Head cinereous-white pollinose, the front and vertex and sometimes the middle of the face ochreous, the orbits whitish. Hair white. Palpi and proboscis blackish white-haired. Antennæ black, the first segment with whitish, the others with yellowish-brown pollen; hair white, the bristles yellow, third segment somewhat longer than the basal two combined, the style short and broad.

Thorax black in ground color, densely cinereous pollinose, the dorsum and mesopleura rather ochreous; mesonotum with five obscure blackish vittæ, the inner pair united with the median vitta in front of the suture and joining the outer pair behind the suture. Mesonotal hair yellowish, short and appressed except in front, along the dorsocentral line and behind; pleural hair white. The sides of the mesonotum behind the suture, and the scutellum, are cinereous.

Legs black, immedite base of the posterior femora, tips of all the femora and the broad bases of the tibiæ, reddish. Femora cinereous pollinose except below. Hair and bristles white.

Wings cinereous hyaline; veins brownish, yellow basally. Halteres reddish-yellow.

Abdomen shining black, the sides whitish pollinose, the pollen produced inward as rather short triangles on the posterior part of the third to sixth segments, the broad apex of the seventh and the whole of the following segments pollinose. Hair black on the black area, white on the pollinose parts, very short and appressed on the dorsum. Venter cinereous-yellow pollinose and pilose.

TYPES.—Holotype, female, Kentucky, July 16; paratype, female, "Ohio."

In the color of the legs this species resembles *canadensis* Curran but the much shorter pile on the thorax, almost golden, broad, anterior band on the mesonotum and ochreous pollinose front distinguish it.

Laphystia litoralis, new species

Related to *canadensis* Curran but with more abundant pile on the mesonotum and the pollinose fasciæ on the second and third abdominal segments usually entire. Length, 11 to 12 mm.

MALE.—Head whitish or very pale yellowish-pollinose, the hair white, abundant. Palpi and proboscis blackish. Antennæ black, brownish pollinose, the basal segment with whitish pollen; hair whitish, the third segment usually with a short hair above near the middle; style short and broad.

Thorax yellowish-white pollinose, the mesonotum with ochreous tinge on the disc; pile white, erect, none of it appressed.

Legs black, the hair and bristles white; immediate base of the posterior femora, tips of all the femora and the broad bases of all the tibiæ reddish yellow; coxæ whitish pollinose, the femora without pollen except on the upper side of the posterior pair at the apex.

Wings hyaline; veins brownish, yellow basally. Squamæ yellow.

Abdomen shining black, with whitish or pale cinereous pollen, the hair white. First segment, sides of the abdomen and posterior fasciæ on the second and following segments densely pollinose, the posterior fasciæ on the fourth, fifth and sixth segments interrupted in the middle, that on the third segment only narrowly, so, or even entire, the inner ends of the transverse spots pointed. Seventh segment without pollen; first segment wholly pollinose.

FEMALE.—The pollinose bands on the third and following segments are sometimes more widely interrupted and more pointed inwardly, and the eighth and ninth segments are pollinose.

TYPES.—Four males and ten females, Rockaway, New York, August 13 and 19, 1903 (J. L. Zabrisky) and one female, Avalon, New Jersey, July 29, 1914. The holotype, male, and allotype, female, were taken at Rockaway on August 19.

Although *litoralis* resembles *canadensis* the absence of pollen on the femora and more abundant pile on the thorax will serve to distinguish it.

Laphystia rufiventris, new species

Black, the dorsum of the abdomen dark shining reddish on more than the apical half; knees reddish; wings cinereous-hyaline. Length, 11 mm.

FEMALE.—Head black in ground color, probably white pollinose (stained), the hair and bristles white. Proboscis and palpi shining black. Antennæ black; third segment about as long as the two basal combined; style very broad, not longer than wide.

Thorax black, the color of the pollen not determinable; hair and bristles brassy yellow, the mesonotal hair very short and appressed except a few long hairs posteriorly. Trichostical hair yellow.

Legs black, the tips of the femora reddish, the bases of the tibiæ narrowly reddish yellow. Hair and bristles of the legs whitish, the hair short and appressed.

Wings cinereous hyaline, the veins brown, those at the base of the wings reddish; anal cell short petiolate apically. Halteres reddish.

Abdomen black, the dorsum reddish, the bases of the third and fourth segments black with reddish tinge, the sides of the abdomen wholly black. Venter black. Hair pale yellow, very short and appressed dorsally, the dorsum of the second and third segments with golden-brown hair except apically and on the sides. The sides of the first six segments are evidently pollinose except behind, but there is no trace of posterior transverse spots. Apical segment reddish yellow.

TYPE.—Female, Green River, Wyoming, July 2, 1920 (F. E. Lutz).

Although I have but a single stained specimen of this species I have no hesitation in describing it. The color of the abdomen and arrangement of the pollen are distinctive and the species cannot well be confused with *limatula* Coquillett. No doubt the amount of red on the abdomen will be found to be quite variable, but even though specimens in which the abdomen is all black should be found, the black legs and absence of transverse pollinose spots on the abdomen would provide a ready means for its identification.

Laphystia salti, new species

A beautiful large species, unusually robust, the abdomen clothed with dense, appressed golden tomentum and without erect hairs. Length, 13 mm.

FEMALE.—Head black in ground color, cinereous pollinose, the hair and bristles shining yellowish, face with an arched row of eight bristles above the oral margin. Proboscis and palpi shining black, the hair and bristles yellow. Antennæ dark reddish, the basal segment blackish, the second brown on the outer side; hair yellow; style broader than long.

Thorax black in ground color, with appressed golden tomentum on the anterior third, lateral and posterior borders of the mesonotum, along the suture, on the upper border of the mesopleura and the broad base of the scutellum; disc of the mesonotum with very short black hair; pleura brown pollinose, a large area above the front coxæ cinereous yellow; hair sparse, yellowish, the trichostical bristles golden. The black color of the mesonotum is produced forward into the anterior tomentose band as a slender triangle.

Legs black; tibiæ and tarsi brownish red; hair yellow, appressed, brown on the ventral surfaces of the femora; posterior femora swollen and with a row of five setigerous tubercles on either side of the ventral surface. Coxæ brown pollinose and yellow-haired.

Wings brownish, brownish yellow in front. First posterior cell closed and petiolate; anal cell short petiolate at the apex. Halteres reddish.

Abdomen black in ground color, the dorsum densely golden tomentose, the disc of the third and fourth segments with very short black hair except on the narrow base. Venter brown pollinose, the hair yellow, mostly appressed.

TYPE.—Female, Cienaga, Magdalena, Colombia, November 14, 1926 (G. Salt), ex Curran collection.

It is probable that this species should be placed in a separate genus on account of its robust legs, the presence of stout bristles on the posterior femora and apically petiolate first posterior cell. The bristles on the sides of the abdomen are also shorter and stouter than is usual in *Laphystia*.

Laphystia scalaris Hermann

Black or brown, opaque, the abdominal segments with rather narrow, apical cinereous pollinose fasciæ. Length, 9 to 11 mm.

MALE.—Head whitish pollinose, the front and upper part of the occiput rather ochreous. Hair and bristles whitish, the frontal hair, occipital cilia and bristles on the antennæ yellowish. The mystax is composed of a row of bristles along the oral margin and several bristles in the middle of the lower half of the face arranged in a triangle, the usual facial hair present. Proboscis and palpi shining black, the hair white. Antennæ black, yellowish-brown pollinose, the first segment cinereous above;

hair yellowish on the first segment, the second with black bristly hair; style short, tapering.

Thorax black in ground color, the mesonotum and mesopleura brownish-yellow pollinose, the pleura mostly whitish, the mesonotum with four brown vittæ, the median pair narrowly separated, the outer pair broad and interrupted at the suture. Hair of the mesonotum appressed, very short, black, the bristles yellow. Pleura with pale yellowish hair. Scutellum with two yellowish marginal bristles and hair similar to that on the mesonotum.

Legs black, the coxæ and femora cinereous pollinose, the hair yellowish. Bases of all the femora, the posterior pair broadly so, tips of the femora and the bases of all the tibiæ reddish. Bristles yellowish; tibiæ and tarsi with yellowish-white hair.

Wings cinereous-hyaline or tinged with brown, the veins brown, brownish red basally. First posterior cell not narrowed apically. Halteres reddish.

Abdomen opaque brown, the sides cinereous pollinose, the segments with bands of similar pollen on the apical third or slightly more, the pale fasciæ somewhat widened in the middle. Venter cinereous pollinose. Hair and bristles yellowish or cinereous, the dorsum with very short, appressed black hair. Genitalia shining black, the lateral lamellæ pale pollinose and armed at the apex with five long, yellow bristles.

FEMALE.—Pale abdominal fasciæ a little narrower, the eighth and ninth segments wholly pollinose, the ovipositor shining black.

One male and two females from Peru.

As may be gleaned from the description, this species differs from the Nearctic species by the presence of strong scutellar bristles and bristles on the male genitalia.

ANDRENOSOMA Rondani

The American flies placed in the genus *Nusa* Walker by most authors belong to the genera *Andrenosoma* and *Pilica*, new genus. The nearest related genus occurring in America is *Pogonosoma* Rondani, which possesses the same type of ovipositor. The genus *Nusa* does not occur in America. The three American genera mentioned above may be distinguished as follows:

1.—Only two submarginal cells............ ....2.
Three submarginal cells...........................*Pogonosoma* Rondani.
2.—Lateral slopes of the metanotum, inside the base of the halteres, bare.
Andrenosoma Rondani.
Lateral slopes of metanotum pilose above the base of the abdomen.
Pilica, new genus.

TABLE OF SPECIES[1]

1.—Abdomen, including the ovipositor, wholly black; wing veins broadly bordered with brown.......................................*camposi*, n. sp.
Abdomen not wholly black, at least the apex reddish.. .... 2.

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[1] I am not sure that all of the species included in this key belong to the genus since Hermann included *olbus* Walker in this section of his key, from which my key is adapted. I have some of the same specimens of *olbus* examined by Hermann and they all belong to *Pilica*. I have accepted Hermann's interpretation of *pyrrhacra* and *erythropyga* but the types must be examined before their identity can be definitely established.

2.—Apical fourth or slightly more, of the posterior tibiæ strongly enlarged. *pygophora* Schiner.
Posterior tibiæ not suddenly enlarged....................................3.
3.—Abdomen mostly reddish..4.
Abdomen blackish, the apex reddish or yellowish........................6.
4.—Posterior tibiæ mostly reddish....................*xanthocnema* Wiedemann.
Posterior tibiæ black..5.
5.—All the tibiæ black..................................*calogastra* Philippi.
Anterior four tibiæ reddish on the basal half............*rufiventris* Blanchard.
6.—Abdomen dark brown, with clay-yellow pollen............*sarcophaga* Hermann.
Abdomen black, the pollen white; apex reddish..........................7.
7.—Sides of the front with several long black bristles...............?*pyrrhacra* Say.
Sides of the front with a single black bristle...........?*erythropyga* Wiedemann.

Andrenosoma camposi, new species

Wholly black, the abdomen with metallic reflections but not at all cyaneous or purplish; wing veins broadly clouded with brown. Length, about 22 mm.

FEMALE.—Head with yellowish-brown pollen, the vertex and facial knob bare, the posterior orbits cinereous; hair and bristles black, the sides of the face with fine yellow hair. Palpi compressed, gently concave on the outer side, black-haired. Antennæ black (third segment missing).

Thorax dull black, the mesonotum with a large shining spot on either side in front of and behind the suture; in the middle with a pair of inconspicuous brownish vittæ, the suture narrowly bordered with brownish on the inner half, the pleura mostly brownish pollinose. Hair wholly black. Lower edge of the scutellum shining, the border with three or four pairs of marginal bristles.

Legs wholly black, the hair and bristles black; coxæ brown pollinose.

Wings grayish, all the veins and the posterior border broadly bordered with brown, so that the wings appear mostly brown. Halteres black.

Abdomen shining black, the dorsum slightly opalescent; first and second segments wholly dull, the third to fifth each with a transverse, opaque triangle on either side behind. Hair wholly black. Ovipositor wholly black, the apical section with yellowish hair.

TYPE.—Female, Guyaquil, Ecuador (F. Campos).

Superficially this species resembles *Pilica olbus* Walker but lacks the bluish or violaceous coloring and the halteres are yellow in *olbus.*

PILICA, new genus

This genus is most closely related to *Andrenosoma* Rondani differing from it in having the lateral metanotal swellings pilose. In all other respects the two genera agree except that the first posterior cell is never closed in *Pilica.* The type of *Pilica* is *Laphria formidolosa* Walker, a species common in Central America. The genus is restricted to America and includes the following species: *Nusa rubidapex* Hermann, *Laphria rufipennis* Wiedemann, *Nusa phonicogaster* Hermann, *Laphria erythro-*

gaster Wiedemann; *Laphria pyrrhopyga* Wiedemann, *Nusa cyrtophora* Wiedemann, *Andrenosoma cyaniventris* Bromley, *Laphria olbus* Walker; *Andrenosoma punctata* Bromley, *Andrenosoma erax* Bromley, *Laphria clausicella* Macquart and *Andrenosoma elegans* Bromley.

Mallophora acra, new species

Related to *guildiana* Williston and *laphroides* Wiedemann. Differs from *guildiana* in having the posterior tibiæ wholly black-haired, the posterior surface reddish-yellow pubescent, and from *laphroides* in having all the femora broadly red basally. Length, 9.5 to 11 mm.

MALE.—Head cinereous-white pollinose and white haired; palpi mostly black-haired, the bristly hairs in the mystax and the coarser frontal hair black. Antennæ black, the first and second segments with black hair apically, the first white-haired on more than the basal half; third segment elongate, narrow, the arista about four-fifths as long.

Thorax yellowish-brown pollinose, white-haired; mesonotum with the discal pile tinged with yellow and with black hairs and bristles on the posterior half.

Coxæ and trochanters cinereous pollinose, the former white-haired. Femora black, broadly reddish basally and apically, sometimes mostly reddish; hair white, on the lower surface of the posterior pair, upper surface of the front pair and the coarse hairs on the middle pair black. Tibiæ reddish, with ferruginous apices; posterior pair black-haired, the others white-haired, with the apices broadly black. Tarsi castaneous, black-haired; pulvilli brown.

Wings cinereous hyaline; grayish in front; first posterior cell petiolate apically. Squamal fringe white. Halteres reddish.

Abdomen dull blackish above, grayish-yellow pollinose below, pile yellowish, white on the first and apical two or three segments. Genitalia reddish.

FEMALE.—Mystax and front with very few black bristles or hairs; anterior four tibiæ with black hairs only in front at the apex; thorax without black hairs posteriorly, but with black bristles. Genitalia reddish or brownish.

TYPES.—Holotype, male, allotype, female, and one male and seven female paratypes, Woods Co., Okla., July 8, 1930, and one female, Major Co., Okla., June 27, 1930 (R. D. Bird).

This species will trace to *laphroides* Wiedemann in the key published on page 12 of American Museum Novitates No. 415. The related species (couplets 12 and 13 of the key) may be separated as follows:

1.—Posterior tibiæ black-haired on the whole length dorsally....................2.
Posterior tibiæ white-haired on the basal half..........................3.
2.—Femora broadly reddish basally..............................*acra* Curran.
Femora black basally..............................*laphroides* Wiedemann.
3.—Femora broadly reddish basally..............................*guildiana* Williston.
Femora black basally..............................*clausicella* Macquart.

Proctacanthus bromleyi, new species

Legs reddish, the coxæ and tarsi black; abdomen reddish, in the female marked with black. Length: male, 23 mm.; female, 26 mm.

MALE.—Head black in ground color, the face reddish, yellowish-cinereous pollinose. Face with yellow hair, the mystax with a row of yellow bristles below and a few black bristly hairs at the upper edge. Frontal hair and bristles black; a few of the occipital cilia black, the others yellow; beard white. Proboscis shining black, the hair yellowish and white. Palpi yellow, with fine white hair. Antennæ black, the first segment reddish; first two segments with yellow hair below, black above; third segment three times as long as wide, the style ferruginous, longer than antenna.

Thorax black, the humeri reddish. Pollen yellowish brown; disc of mesonotum blackish, in some views appearing mostly yellowish brown, in others the poorly separated dull black vittæ are distinct, the median one geminate in front, the outer ones interrupted at the suture. Hair and bristles of the mesonotum black, the dorsocentrals limited to the posterior fifth; a few pale hairs at the base of the scutellum, the scutellum with erect bristly hair, the marginal bristles not distinctly differentiated. Pleura with whitish hair and bristles, the mesopleura and upper part of the sternopleura with black hair.

Legs reddish; coxæ and tarsi black; coxæ densely cinereous pollinose and bearing whitish hair and bristles. Hair and bristles of the legs black, all the tibiæ and the basal two segments of the posterior tarsi bearing short golden-yellow hair posteriorly.

Wings hyaline, tinged with yellowish brown on the apical third. Squamal fringe whitish. Halteres reddish yellow.

Abdomen reddish, cinereous-yellow pollinose, yellow-haired; first segment and sides of the second and third black. Genitalia with short black hair, the inner part of the outer lamellæ with golden-yellow hair.

FEMALE.—Mystax thinner, with one or two pairs of black bristles in the middle below and more numerous black bristly hairs above; palpi with a few black bristly hairs apically. Base of the scutellum broadly whitish-haired, the marginal row of bristles yellowish white. Abdomen black, the first segment and the apices of the following tergites and sternites reddish, only the first five tergites pollinose, the apex of the fifth and the following ones wholly shining. On the fifth to seventh segments the reddish bands are very wide and almost or quite divide the black bands in the middle. Hair black on the dorsum, wholly pale on the first two segments, obscure on the shining area; hair of the venter pale, black on the shining sixth and seventh sternites, but not very conspicuous. Genitalia shining black, bearing very short, erect, bristly hairs and some finer ones; circlet of spines fairly strong and of moderate length.

TYPES.—Holotype, male, and allotype, female, Rio Frio, Magdalena, Colombia, July 2, 1927 (G. Salt), ex Curran collection.

Mr. S. W. Bromley had determined this as a new species and it gives me pleasure to name it in his honor.

P. bromleyi is related to *tibialis* Macquart but the reddish femora serve as a character for its ready separation. The much shorter and differently shaped male genitalia and pale mystax are also distinctive characters. A male of *tibialis* was taken along with these two specimens.

Erax camposiana, new species

A large species, the sixth and seventh segments of the male abdomen silvery white, the basal three cinereous pollinose, fourth and fifth mostly shining black; in the female the dorsum of the abdomen is brownish pollinose, the apices of the segments and the broad sides cinereous; male costa gently dilated. Length, exclusive of genitalia, 22 to 23 mm.

MALE.—Pollen of the head yellowish white, on the front and middle of the face ochreous; hair yellowish; bristles black, those on the lower half of the mystax mostly straw-yellow. Proboscis and palpi black, the hair and bristles yellow except for three or four black bristles on the apex of each palpus. Antennæ black, the first two segments brownish-yellow pollinose, yellowish-haired above, black below; third segment shorter than the first, lance-shaped, convex basally, arista two-sevenths longer than antenna, the apex somewhat broadened.

Thorax black, cinereous pollinose, with the usual black vittæ; a median vitta on the anterior half and the vittæ outside the median black one, yellowish tinged, the black median vitta not nearly reaching the scutellum. Hair black, sparse, not abundant posteriorly; two or three dorsocentrals in front of the suture. Pleura with pale pile in front and a little pale pile on other parts. Scutellum black-haired, with two pairs of strong marginal bristles.

Legs black, the tibiæ reddish yellow with black apices; coxæ cinereous pollinose; hair yellow, black on the dorsal surfaces of the femora at least apically and on the tarsi; bristles mostly black.

Wings tinged with brown, the basal and costal cells hyaline. Anterior branch of the third vein arising slightly beyond the base of the second posterior cell, without appendage (with one in female); costa dilated on subapical fourth. Knob of halteres brown.

Abdomen black in ground color, the first, second and third segments brownish-gray pollinose, the third and fourth broadly brown pollinose on the sides; sixth and seventh segments silvery white. Hair white; the fourth and fifth segments and apex of the third with black hair, except laterally. Venter grayish brown and cinereous pollinose, whitish-haired. Genitalia large, black, the lower lamellæ densely black-haired below; the upper lamellæ densely black-haired at the apex; from lateral view the upper lamellæ are widest at the middle.

FEMALE.—Mystax composed mostly of black bristles; third antennal segment more oval. Six or seven dorsocentrals in front of the suture. Abdomen brown pollinose above, the first segment wholly and the lateral margins of the second to sixth segments very broadly cinereous; seventh segment and ovipositor shining black. Hair white, black on the seventh segment. Ovipositor about 5 mm. long, with almost parallel sides.

TYPES.—Holotype, male, and allotype, female, Guayaquil, Ecuador (F. Campos).

This species is evidently related to *obscurus* Macquart, differing in having the abdomen almost wholly pale-haired and a little more uniform in color and much more strongly developed mesonotal vittæ.

Regasilus, new genus

Related to *Neolophonotus* Engel but the face is gibbous on a little more than the lower half, the mesonotal hairs and bristles are much less numerous along the median line and the abdomen lacks bristles. It differs from *Apoclea* Macquart by possessing median bristles along the whole length of the thorax, and from *Asilus* Linnæus in lacking hair on the mesonotal slopes.

Head as in *Asilus* Linnæus, the lower half of the face gibbous. Mesonotum convex, the middle broadly bristled on the whole length but the bristles not abundant and not forming a "mane." Scutellum with one pair of strong marginal bristles and numerous hairs. Pteropleura with many hairs. Legs simple, the femora, especially the front pair, swollen. Wings with only two submarginal cells the posterior branch of the third vein ending behind the wing-tip. Abdomen extending to beyond the wing-tips, rather slender, gently tapering on the basal part; genitalia small.

GENOTYPE.—*Regasilus strigaria*, new species.

Since I have only a male specimen the character of the ovipositor is unknown. The American species related to *Asilus* have usually been placed in that genus, although they represent several distinct groups. The genus *Asilus* is a small one and comprises not more than a dozen described American species. A careful revision of our fauna will be necessary in order to determine the relationships of the species and to dispose of them in their proper genera.

Regasilus strigaria, new species

Thorax and legs dark reddish, the femora black beneath; mesonotum with a median black vitta and a spot on either side. Length, 16 mm.

MALE.—Head black, grayish-yellow pollinose; face and front with black hair and bristles; occipital pile yellowish, the mystax with some yellowish bristles below. Palpi small, black, pale yellow-haired. Antennæ black, the basal two segments grayish pollinose, black-haired; third segment missing.

Thorax dark reddish, with cinereous-yellow pollen; mesonotum with a broad median, geminate dull black vitta on the anterior three-fourths and an interrupted, posteriorly tapering black vitta on either side behind the suture, the small posterior spot triangular. Hair black, long and bristly on the median fourth; humeri and pleura pale yellowish-haired. Scutellum with the free border blackish, with scattered hair on the disc and one pair of strong marginals. Pleural bristles black.

Legs dark reddish; femora black ventrally, the tarsi ferruginous; hair pale yellowish, black on the femora above, the upper surface of the tibiæ apically and on the tarsi. Coxæ cinereous pollinose and yellowish pilose. Anterior femora with abundant long hair beneath on the basal two-thirds and less abundant black hair apically, without bristles.

Wings hyaline, the anterior cross-vein and the apical fourth of the wing brownish, the dark color especially noticeable along the veins; anterior branch of third vein without appendage. Halteres reddish.

Abdomen black, subshining, with a wide, reddish lateral stripe extending the whole length, widely separated from the sides of the tergites, the reddish color expanded somewhat on the posterior of each segment and forming more or less complete posterior borders to the second and third segments; broad sides of the abdomen and the apices of the segments cinereous-white pollinose. Hair white on the sides and base of the abdomen, black on the dorsum. Genitalia ferruginous, the upper lobes black above. Venter reddish, the sides blackish; pile pale, the apical sternite with a tuft of black hair on the posterior border.

Type.—Male, Guayaquil, Ecuador (F. Campos).

Dysmachus strigitibia, new species

Abdomen uniformly cinereous-yellow pollinose; mesonotum with black vittæ; wings uniformly pale yellowish brown. Length, 16 mm.

Male.—Head black, grayish-yellow pollinose. Front rather narrow, with black hairs and bristles, the ocellar tubercle with eight long, fine bristles. Occipital hair pale yellow, white on the lower half except along the orbits, the short, stout bristles on the upper part of the occiput black. Mystax reaching more than half-way to the antennæ, black, the middle portion dense and whitish on the lower half; facial gibbosity occupying the lower two-thirds of the face; sides and upper part of face without hair. Palpi black, black-haired; proboscis black, mostly yellow-haired. Antennæ black, the basal two segments with mixed black and yellow hair, the black predominating below, the yellow above; third segment missing.

Thorax black, cinereous-yellow pollinose. Mesonotum with the usual dull blackish vittæ, the median one tapering posteriorly and divided by a pale line for more than half its length, the outer vittæ divided at the suture and again above the wings. Hair and bristles of the mesonotum black, the bristles extending the whole length in the middle but not dense; sides with some pale hairs; pleura with pale hair and bristles except on the upper part of the rather brownish mesopleura. Scutellum with short whitish hair and one pair of strong bristles.

Coxæ black, cinereous-yellow pollinose and pilose. Femora black, with conspicuous yellowish pile and bristles, the anterior pair with black bristles; a row of fine ones along the entire ventral surface and some scattered ones above. Tibiæ reddish, yellow-haired, the anterior four black on the anterodorsal surface, all with black apices; bristles yellowish and black. Anterior tibiæ with several long, fine black bristles on either side of the ventral surface, the posterior bristles yellow; no long hairs. Tarsi black, black-haired.

Wings strongly tinged with yellowish brown; the anterior branch of the third vein arises a little beyond the base of the first posterior cell which is twice as wide as the apex of the discal cell. Halteres reddish yellow.

Abdomen black in ground color, densely grayish-ochreous pollinose, entirely clothed with pale yellowish hair and bristles; each segment with an interrupted row of marginal bristles. Venter with four rows of erect, fine yellowish bristles on the whole length. Genitalia rather small, from dorsal view widest near the base.

Type.—Male, Riobamba, Ecuador (F. Campos).

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XIV[1]

By Ernst Mayr

WITH NOTES ON THE GEOGRAPHY OF RENNELL ISLAND AND THE ECOLOGY OF ITS BIRD LIFE

By Hannibal Hamlin

Rennell Island was discovered in 1801 by Captain Butler of H. M. S. 'Walpole.' Among the earliest visitors to the island were Bishops Selwyn and Patteson of the Melanesian Mission in 1856, who recognized the Polynesian affinities of the natives. Undoubtedly there were trading vessels and possibly whalers that called in the old days, but they left no record of their visits. Information about Rennell is both scanty and scattered, although its location has been known to local navigators for many years. The first regular steamer connecting the Solomon group and Australian ports used to sail on a course set for Rennell as a landfall after leaving the Queensland coast. But no European settlement was ever contemplated and no trading station established, principally because of a lack of sheltered anchorage and the island's relative isolation.

The bay on the southwestern coast is the only one that affords protected holding ground for a ship of any size. A plan of this was made by Commander Robert Crookshank, R. N. (retired), who was captain of the Whitney Expedition schooner 'France' during her first visit; it was subsequently published as No. 209 by the Admiralty and described in the 'Sailing Directions.'

The natives of San Cristobal and Guadalcanal tell several fantastic stories about Rennell and its inhabitants. Apparently its existence has always been known to them, although intercommunication was impossible.

Charles M. Woodford, C. M. G., published the earliest authoritative account of Rennell,[2] which he visited in 1906, the trip having been made chiefly in his capacity as the first Resident Commissioner of the British Islands Protectorate. Woodford was an accomplished naturalist and had sent many fine bird collections to the British Museum before his government appointment, but on this occasion he managed to capture only one specimen. His description is as follows:

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[1] Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, and 486.

[2] 1916, 'On Some Little-known Polynesian Settlements in the Neighborhood of the Solomons.' The Geographical Journal, XLVIII, No. 1, pp. 45–49.

> During my short visit I obtained one most singular bird which has been described as a new genus and species under the name of *Woodfordia superciliosa.* A description and plate of this bird have recently been published in The Ibis (Ibis, January, 1916). At Rennell I also noticed the black-headed Ibis (*Ibis strictipennis,* Gould) a bird which during a thirty years' experience of the Solomons I have never seen there, nor has it been recorded by others.

This single specimen of *Woodfordia,* a genus included under the Zosteropidæ, was the only example of the Rennell avifauna known to ornithology prior to the visits of the Whitney Expedition.

A. S. Meek, the most successful bird collector on the Solomon Islands, discussed with Lord Rothschild and Dr. Hartert the possibilities of a prolonged visit to Rennell in connection with his collecting trips through the Solomons in the interests of the Tring Museum, but the prospect was abandoned as impracticable.

Bellona, a small island of regular shape, having a circumference of about eight miles, lies fifteen miles northeast of Rennell. A visit to both islands, following that of Woodford, is recorded for the same year (1906) by a Mr. Alfred Stephen of Sydney, who was searching for phosphate. Between the years 1909 and 1911 Dr. Northcote Deck and J. Hedley Abbott visited Rennell several times in the hope of establishing a station for the South Sea Evangelical Mission. They were able to examine the island more thoroughly than anyone had before, and Dr. Deck published an account which deals chiefly with the population.[1]

During September and October of 1927, G. A. Stanley and J. H. Hogbin spent several weeks on Rennell in behalf of the government of New South Wales and the University of Sydney. The results of their explorations add considerably to the general physiographical knowledge of the island, although only one article about the expedition has appeared.[2]

Rennell is the southernmost island of the British Solomon Islands. Lying in lat. 11° 40′ S., and long, 160° 18′ E., it is approximately ninety miles southwestward of San Cristobal, a position somewhat isolated in relation to the rest of the group. Its shape is long and narrow, aligned along the general path of the trade wind, and measures forty-two miles in an east-southeast to west-northwest direction, and not more than twelve miles in breadth at its widest part. Topographically it resembles a kind of platter, and it has been cited as the most remarkable example of an elevated atoll in existence. The altitude of the island is uniformly between 300 and 400 feet, the terrain rising abruptly from the sea in terraced bluffs and cliffs of coralline limestone. Sandy beaches occur along the coast in scattered places; many of them covered at high water.

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[1] 1921, The Geographical Journal, LVII, No. 6, pp. 474–479.

[2] 1928, G. A. Stanley, 'Physiographic notes on some of the British Solomon Islands.' The Australian Geographer, I, pp. 29–39.

The geological history of Rennell implies that only the higher parts of the outer rim were once at sea-level in the annular form of an atoll. There is a marked central depression which slopes to an elevation approximating sea-level toward the southeastern half, where there is an inland lake ten miles long and three miles across which the natives call "Tengano." Although entirely separated from the coast on all sides, continual seepage occurs through fissures in the limestone. This rough, coralline rock, which varies considerably in lithological character, appears to be the prevailing formation. Fossil corals and shells are nearly always visible. Patches of reddish soil, however, occur throughout the inland area and offer fertile ground for cultivation.

The Whitney Expedition visited Rennell Island on two occasions on the schooner 'France,' anchoring in the same locality both times—Kungava Bay on the southwestern side. The first visit occupied eleven days (August 27–September 7, 1928) and yielded by far the greater part of the collection. A week's time was put in on daily trips from the vessel, an active staff of four field workers, the writer and three trained Polynesian assistants, making the most of good weather. A stay in camp near the inland lake was shortened to only three days due to lack of ammunition. About 240 specimens representing 25 species were taken during this time; a few of these inhabit the lake region exclusively. The second visit occupied about a fortnight (May 17–29, 1930) and was accompanied by an unusual run of rainy weather that impeded the collecting to a considerable degree. Despite this fact 140 skins were prepared, including eight species not before taken, and additional specimens of species previously not well represented. On this occasion the field party was composed of the writer, William F. Coultas, and Walter J. Eyerdam.

One day of our time was spent at Bellona Island where the hunting produced no forms that varied from those taken on Rennell. A single example of *Accipiter fasciatus* was shot and two species of cuckoos.[1]

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[1] *Cacomantis pyrrhophanus* and *Chalcites lucidus*.

A longer stay might have yielded further results; but only under extraordinary weather conditions can the island be approached safely. With a sea of any size running it would be impossible to land. We were very anxious to investigate Bellona, particularly because it differs considerably from Rennell in formation. The elevation does not exceed 150 feet, and the superabundance of coralline limestone so typical of the larger island does not occur. Inland the forest has a floor of rich earth with spots of coral rock. The undergrowth of vegetation is very thick, and large trees are quite plentiful. It would have been interesting to have found what bird species were absent as compared with Rennell. The one most in evidence proved to be the blue coot (*Porphyrio albus*); so much so that the natives fence in their gardens against its depredations. Other species noted in this hasty survey were *Ducula pacifica, Ptilinopus rhodostictus, Aplonis insularis, Halcyon chloris,* and *Coracina lineata.*

At Rennell we were able to spend the time necessary to observe the bird distribution in its relation to habitat and landscape. The whole island is densely wooded but in varying degrees. The character of the forest depends on the interspersion of coralline limestone, the predominating formation, which stunts the growth of vegetation wherever it occurs. Low trees are in great abundance (varying from 20 to 50 feet in height). Smaller saplings and underbrush are thick wherever root-hold can be obtained in soil. Bushes grow out of interstices in the coral and many varieties of vines entwine the tops of the smaller trees. The great, lofty ones, that grow over extensive areas on other tropical islands of non-atoll origin, are noticeably segregated.

It is remarkable how many of the more common passerines inhabit the lower vegetation. In addition to *Gallicolumba beccarii* and *Calœnas nicobarica,* which are wholly ground-dwelling, two species—*Pachycephala feminina* and *Turdus poliocephalus*—are usually seen hopping about on the points of coral or in the very low shrubbery. Slightly higher, not more than ten or fifteen feet above the ground, the insectivorous flycatchers and fantails find their best hunting ground, *Pinarolestes hamlini* and *Rhipidura rennelliana* being the most common. The latter would answer and approach readily when called.

Gerygone flavolateralis we found extremely tame; individuals often had to be frightened away from a too close gun range. This species would be included in a group whose vertical distribution in the forest is more general, ranging higher up in the foliage of the lower trees. They might be called "lower tree inhabitants": *Zosterops rennelliana, Myzomela cardinalis,* and *Aplonis insularis.*

Relatively few species are found in the tops of the higher trees, only one in particular, *Ducula pacifica*, the common pigeon which calls from the topmost branches. Of more general distribution in the upper forest are a beautiful little dove (*Ptilinopus rhodostictus*) and two lorries (*Lorius chlorocercus* and *Geoffroyus heteroclitus*). The fruit and nut trees are the highest ones, so the attraction would appear to be food interest. Both the pigeon and the dove are captured by natives and tamed as pets.

Another type of landscape is provided by native gardens where smaller passerines are often found feeding, usually in the lower trees and secondary growth along the edges. As in the case of Bellona, the blue coot (*Porphyrio*) is common, being considered a pest by the natives. Many of the plantations include groves of papaya, a fruit that was introduced about two decades ago, according to report. *Woodfordia superciliosa*, the species that first attracted the attention of ornithologists to Rennell, is perhaps the easiest bird to collect because of a preference for the papaya trees where it regularly feeds in considerable numbers. While often seen in the low trees of the forest, *Woodfordia* is noticeably more common in the papaya groves.

The vicinity of the lake offers a specialized habitat that harbors several species, notably those living primarily on its surface, the two species of duck (*Anas superciliosa* and *Anas gibberifrons*), the grebe (*Colymbus ruficollis*), and the cormorant (*Phalacrocorax melanoleucus*). The larger teal and the cormorant are plentiful compared to the others, but none of the lake species is easily collected because of the attendant difficulties. One has to be navigated around in a cumbersome canoe, shooting in hit-or-miss fashion with no possibility of concealment. All of our hunting was done around the western end of the lake which is dotted with islets. A great deal of the lake shore and these islets in particular support extensive patches of pandanus. Small birds are very uncommon in this kind of vegetation. One species noted, not entirely confined to the lake district, but more common thereabouts, is the ibis (*Threskiornis æthiopicus pygmæus*). Toward evening great flocks of them are usually seen flying silently away from the lake toward the forest. Several specimens were taken near the saltw-ater coast; and I have seen individuals fly up from the edge of the clearings along bush trails and from native gardens. Both the ibis and grebe were nesting when the expedition conducted its first trip; three nests of the latter were discovered and clutches of eggs collected.

Very little can be written about the spoonbill (*Platalea leucorodia regia*), another member of the lake-dwelling community. One example, a rather immature specimen, was shot on our second visit. I have noted that two were seen during the first, one flying low over the pandanus trees close to the lake shore, and the other sitting on the branch of a dead tree. The natives seemed to regard this species with some degree of awe and professed to have no knowledge of its habits. They were able to impart valuable information about most of the other birds, but nothing important concerning the spoonbill. According to their stories the few representatives of the species had been on the island ever since its existence, and were under the particular patronage of their god. We were fortunate in being able to carry away our single skin.

In general the avifauna of Rennell distributes itself by habitat and landscape into the lake vicinity species and those inhabiting the forest. The latter have been described as belonging to the particular kind of forest environment in which they were most often encountered. Their surroundings, their feeding, and their adjustments appear to be as natural as one could wish to find on an island inhabited by man. The presence and activity of the natives does not seem to have affected their habits to any great degree. There are no mammals, either indigenous or introduced, except a few species of bats which are harmless. In this respect Rennell is unique for an island of its size in the western Pacific. Rarely visited until recently, its fauna had been undisturbed and was practically unknown to natural science until visited by the Whitney Expedition. The material now available offers to Dr. Mayr an opportunity for long-awaited investigation of great importance.

SOME NATIVE NAMES

Colymbus ruficollis	manusingé
Phalacrocorax melanoleucus	manugitai
Dupetor flavicollis	tagoa
Platalea regia	tetonga
Threskiornis æthiopicus	tatagoa
Anas superciliosa	teganinali
Anas gibberifrons	teganinali
Accipiter fasciatus	tetaba
Porphyrio albus	tekongai
Ducula pacifica	tengupé
Lorius chlorocercus	tesibingé
Geoffroyus heteroclitus	tegithua
Collocalia esculenta	tapekapeka
Hemiprocne mystacea	tebabenubenu
Coracina lineata	tetingovai
Aplonis insularis	tegapidu
Turdus poliocephalus	tengangangau
Myiagra vanikorensis	tatongivitongi

THE RELATIONSHIPS AND ORIGIN OF THE BIRDS OF RENNELL ISLAND

The Zoögeographical Position of Rennell Island

Before we analyze distributionally the 38 species known from Rennell Island, we should first eliminate the five species not known to nest on the island. They are three seabirds and two migrants from Australia.

Non-breeding Species

11.[1]—*Sterna sumatrana sumatrana* Raffles
12.—*Sterna bergii cristata* Stephens
13.—*Anous stolidus pileatus* (Scopoli)
22.—*Chalcites lucidus* (Gmelin)
26.—*Halcyon sancta* Vigors and Horsfield

In the remaining 33 species we have to distinguish between endemic species and subspecies and those which are also found on other islands.

Breeding Species

I.—Endemic species and subspecies
  A.—With the closest relative on the Solomon Islands (northwest of Rennell Island).
    2.—*Phalacrocorax melanoleucus brevicauda*
    4.—*Dupetor flavicollis pallidior*
    14.—*Ptilinopus rhodostictus cyanopterus*
    19.—*Geoffroyus heteroclitus hyacinthinus*
    23.—*Collocalia esculenta desiderata*
    27.—*Coracina lineata gracilis*
    29.—*Aplonis insularis*
    37.—*Zosterops rennelliana*
  B.—With the closest relative on the Santa Cruz group or the New Hebrides Island (southeast).
    1.—*Colymbus ruficollis longirostris*
    25.—*Halcyon chloris amoena*
    31.—*Gerygone flavolateralis citrina*
    32.—*Pinarolestes hamlini*
    33.—*Myiagra vanikorensis occidentalis*
    34.—*Rhipidura rennelliana*
    38.—*Woodfordia superciliosa*
  C.—With close relatives both east and west (the systematic position of the Rennell bird intermediate between its representatives on the Solomon Islands and Santa Cruz-New Hebrides).
    30.—*Turdus poliocephalus rennellianus*
    35.—*Pachycephala feminina*
    36.—*Myzomela cardinalis sanfordi*
  D.—With the closest relative in New Guinea and Australia.
    6.—*Threskiornis æthiopicus pygmæus*

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[1] Numbers refer to the numbered species in American Museum Novitates No. 486.

SUMMARY

Of these 19 endemic forms 8 (=42 per cent) point to an origin from the Solomon Islands, 7 (=37 per cent) point to an origin from Santa Cruz-New Hebrides Islands. This slight difference lies within the limit of a possible error and we can say that in the endemic forms the influence from the Solomon Islands and from the Santa Cruz-New Hebrides Islands is equally strong.

II.—Non-endemic species and subspecies
- A.—The same species or subspecies also occurs on the Santa Cruz Group and the New Hebrides Islands.
  - None.
- B.—The same species or subspecies also occurs on the Solomon Islands.
  - 16.—*Gallicolumba beccarii solomonensis*
  - 17.—*Calœnas nicobarica nicobarica*
  - 18.—*Lorius chlorocercus*
  - 20.—*Micropsitta finschii finschii*
  - 21.—*Cacomantis pyrrhophanus meeki*
  - 24.—*Hemiprocne mystacea woodfordiana*
  - 28.—*Aplonis cantoroides cantoroides*
- C.—The same species or subspecies also occurs in Australia (and on neighboring islands, as New Caledonia or New Guinea).
  - 5.—*Platalea leucorodia regia*
  - 8.—*Anas gibberifrons gibberifrons*
  - 9.—*Accipiter fasciatus vigilax*
- D.—The species is widespread (east and west of Rennell Island).
  - 3.—*Demigretta sacra*
  - 7.—*Anas superciliosa pelewensis*
  - 10.—*Porphyrio albus subspecies*
  - 15.—*Ducula pacifica tarrali*

SUMMARY

Of the 14 not endemic forms

7=50 per cent point to a northern origin
3=21 per cent point to a southern origin
4=29 per cent are widespread

What do these figures mean?

THE ORIGIN OF THE RENNELL ISLAND BIRD LIFE

Rennell Island is a raised atoll which is separated from the nearest land by oceanic basins of a depth of 4000–5000 meters. It is therefore a true oceanic island. All the birds there must have reached it by a long distance flight across the separating sea. The nearest islands are the

Solomon Islands in the north, which are 90 miles away (San Cristobal), the Santa Cruz group in the east, which is 350 miles away, and the Louisiade Archipelago in the west, which is 370 miles away.

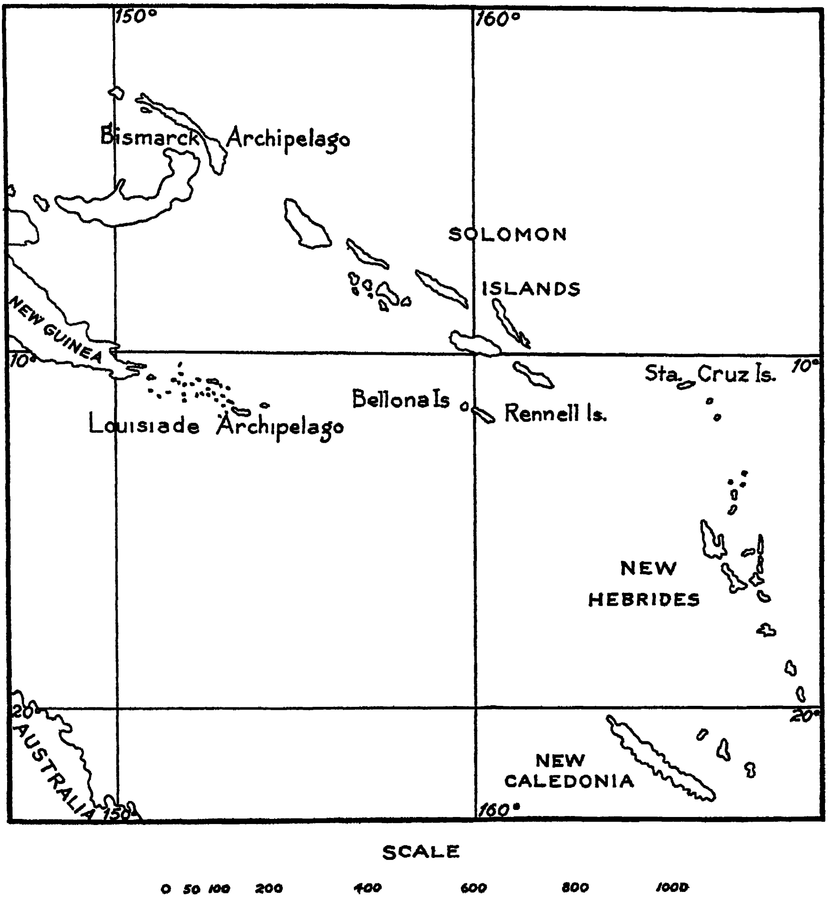

Fig. 1. Relative position of Rennell Island.

The different degree of speciation suggests that the time of immigration has not been the same for all the species. We have endemic forms of a very high degree of independent evolution (as *Pinarolestes hamlini*) and others which are barely different from the neighboring forms. Subspecies deriving from Solomon Island forms are more likely to be "swamped" by newcomers from the same source, as the distance is not very considerable. Thus we find that most of the subspecies with Solomon Islands relationships are only slightly differentiated, while those which are related to forms on the New Hebrides are much more marked.

Single birds cannot establish a settlement on an island; we might expect, as indeed we find, that most of the birds living on such isolated islands as Rennell are of a social nature. They have probably come to this outlying place in little flocks.

As the Solomon Islands are almost in sight of Rennell Island, we would expect an overwhelming percentage of its bird life to be derived from that group. It is therefore somewhat surprising to find such a strong element showing New Hebrides affinities. Unfortunately, the bird life of the New Hebrides is not very well known, so we do not know exactly how many of its species are missing from Rennell Island. However, a hasty survey of the birds collected by the Whitney Expedition on the Santa Cruz group convinces me that almost every species is also represented on Rennell Island. Even the eastern part of the Solomon Islands shows a certain eastern component. The species *Myzomela cardinalis*, *Ptilinopus rhodostictus*, and *Cacomantis pyrrhophanus* may be mentioned in this connection.

As I have said above, all the birds of Rennell Island must have reached it across the sea. There are three possible sources of immigrants.

I.—The New Hebrides and Santa Cruz group (east and southeast of Rennell Island).

II.—The Solomon Islands (northeast, north, and northwest of Rennell Island).

III.—The Louisiade Archipelago, New Guinea, and Australia (west and southwest).

A study of the prevailing winds in the neighborhood of Rennell Island shows that (according to the 'Pilot Chart of the South Pacific Ocean'[1]):

about 56 per cent come from the southeast or east
about 16 per cent come from the northeast, north, or northwest
about 5 per cent come from the west and southwest
about 23 per cent come from the south or are calms (no zoögeographical significance).

These figures, when considered in conjunction with the distances of the above-named three sources of the Rennell Island population, throw some light on the reasons for the present percentages of Rennell Island bird population with relation to origin.

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[1] Published by the Hydrographic Office, Washington, D. C.

The ecological conditions on Rennell Island are of a very distinct type. As I have said, the Santa Cruz Islands have similar conditions and therefore most of the birds occurring on the Santa Cruz Islands also occur on Rennell Island. On the other hand, the Solomon Islands have a great diversity of environment, and only a very limited number of Solomon Island birds could adjust themselves to the life conditions on Rennell Island.

It is perhaps worth while to consider the negative side of the problem and ask: Which of the Solomon birds live on small coral islands but do NOT occur at Rennell? Besides the birds found on Rennell Island I would have expected: *Megapodius*, *Macropygia rufa*, *Eos cardinalis*, *Trichoglossus*, and *Monarcha cinerascens*. Further exploration may prove that one or the other of these species does occur on Rennell Island, so I refrain for the present from commenting on the possible causes of their absence.

All the species found on Rennell Island which have their closest relatives in the southwest or west (New Guinea and Australia) are large birds with considerable power of flight. They were able to reach Rennell Island in spite of contrary winds.

SUMMARY

1.—Rennell Island is an oceanic island which was populated from three different sources: the Santa Cruz Islands and New Hebrides in the east, the Solomon Islands in the north, and New Guinea and Australia in the west and southwest.

2.—The direction of the prevailing winds and the distance from the mentioned islands determined the percentage of the faunistic elements.

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THE PARROT FINCHES (GENUS *ERYTHRURA*)

BY ERNST MAYR

In order to have the Polynesian material of the genus *Erythrura* available for exchange, I found it advisable to make a revision of the whole group, which yielded some very interesting results.

The genus of the parrot finches comprises several very distinct species which differ from each other not only in color pattern, but also in proportions and other morphological characters, such as the shape of tail and bill, size of legs, etc. For this reason, the genus has been split up by several ornithologists into a group of monotypic genera. Although I do not deny some of the minor morphological differences existing between the various species belonging to the genus *Erythrura*, I do not wish to split up the natural group which is formed by the seven species of the genus. The use of subgenera will be sufficient to express the natural affinities.

The genus *Chlorura* has always been separated from the other *Erythrura*. But *hyperythra* (the only species of the subgenus *Chlorura*) is really much closer to *prasina*, the typical species of the genus *Erythrura*, than any of the Polynesian species. Apparently *hyperythra* represents the most primitive species of the genus.

Only the Polynesian species of the genus will be treated in detail; the Malayan and Papuan species will be listed only.

ERYTHRURA Swainson

Subgenus **REICHENOWIA** Poche

Reichenowia POCHE, 1904, Ornith. Monatsber., XII, p. 26, new name for *Chlorura* Reichenbach, 1862–1863, 'Die Singvogel,' p. 33. Type (by monotypy): *Chlorura hyperythra* Reichenbach. Not *Chlorura* P. L. Sclater, Sept. 1861, 'Cat. Coll. Amer. Birds,' 1861–1862, p. 117; subgenus of *Embernagra*, type (by tautonymy): *Fringilla chlorura* Audubon. Not *Chlorurus* Swainson, 1839, 'Hist. Class. Fish. VII,' vol. II, p. 227.

SUBGENERIC CHARACTERS.—Bill laterally compressed near tip; upper mandible sometimes with distinct ridge; tail graduated not at all, or very little; central pair of tail-feathers not distinctly prolonged; no red in plumage.

Erythrura hyperythra Reichenbach

RANGE.—Malakka Peninsula, Greater and Lesser Sunda Islands, and Celebes.

Erythrura hyperythra malayana (Robinson)

Chlorura hyperythra malayana ROBINSON, 1928, Bull. Brit. Orn. Club, XLVIII, p. 72. Telom (Camerons Highlands), Perak-Pahang boundary, Malay Peninsula.

RANGE.—Known only from the type specimen.

Erythrura hyperythra borneensis (Sharpe)

Chlorura borneensis SHARPE, 1889, Ann. Mag. Nat. Hist., (6) III, p. 424. Mt. Kina Balu, Borneo.

RANGE.—High Mountains of Borneo.

Erythrura hyperythra hyperythra (Reichenbach)

Chlorura hyperythra REICHENBACH, 1863, 'Die Singvögel,' p. 33. "New Guinea" (error), Java.

RANGE.—Java.

Erythrura hyperythra intermedia (Hartert)

Chlorura intermedia HARTERT, 1896, Nov. Zool., III, p. 558. Lombok.

RANGE.—Lombok (Lesser Sunda Islands).

Erythrura hyperythra obscura (Rensch)

Chlorura hyperythra obscura RENSCH, 1928, Ornith. Monatsber., XXXVI, p. 6. Sita, West Flores.

RANGE.—Sumbawa and Flores (Lesser Sunda Islands).

Erythrura hyperythra microrhyncha (Stresemann)

Chlorura hyperythra microrhyncha STRESEMANN, 1931, Ornith. Monatsber., XXXIX, p. 12. Latimodjon Mountains, Celebes.

RANGE.—Western slopes of Latimodjon Mountains, Celebes.

Erythrura hyperythra brunneiventris (Ogilvie-Grant)

Chlorura brunneiventris OGILVIE-GRANT, 1894, Bull. Brit. Orn. Club, III, p. 50. Luzon.

RANGE.—Luzon and Mindoro (Philippine Islands).

Subgenus **ERYTHRURA** Swainson

Erythura (typographical error for *Erythrura*) SWAINSON, 1837, 'Classification of Birds,' II, p. 280. Type (by monotypy): *E. viridis* Temminck and Laug., Pl. Col 96 = *Loxia prasina* Sparrman.

For the several species of this subgenus the following generic names were introduced, but must be regarded as synonyms:

For: *prasina* Sparrmann

Erythrina BLYTH, 1852, 'Cat. Birds Mus. As. Soc.,' (1849), p. 118. Type (by monotypy): *L. prasina* Sparrmann [not *Erythrina* C. L. Brehm].

For: *trichroa* Kittlitz

Trichroa REICHENBACH, late 1862 or 1863, 'Die Singvögel,' p. 33. Type (by tautonymy): *Fringilla trichroa* Kittlitz [not *Trichrous* CHEVROLAT, 1858, Rev. Mag. Zool., X, p. 210].

Lobospingus DE VIS, 1897, Ibis, p. 389. Type (by monotypy): *Lobospingus sigillifer* De Vis.

Chloromunia MATHEWS, Austr. Av. Rec., V, p. 40. Type (by orig. des.): *Erythrura trichroa macgillivrayi* Mathews.

For: *psittacea* Gmelin

Acalanthe REICHENBACH, 1862/1863, 'Die Singvogel,' p. 32. Type (by monotypy): *Fringilla psittacea* Gmelin.

For: *cyanovirens* Peale

Amblynura REICHENBACH, 1862/1863, 'Die Singvögel,' p. 32. Type (by subs. des., Sharpe, 1890, 'Cat. Birds Brit. Mus.,' XIII, p. 280): *Erythrura pealii* Hartlaub.

Lobiospiza HARTLAUB AND FINSCH, 1870, Proc. Zool. Soc. London, p. 817. Type (by monotypy): *Lobiospiza notabilis* Hartlaub and Finsch.

SUBGENERIC CHARACTERS.—Bill usually compressed laterally near tip; upper mandible in most forms with a ridge; tail slightly or strongly graduated; central pair of tail-feathers pointed and more or less elongated; always some parts of the plumage red, at least tail and upper tail-coverts.

Erythrura prasina (Sparrman)

DISTRIBUTION.—Part of Malay-India and Greater Sunda Islands.

Erythrura prasina prasina (Sparrman)

Loxia prasina SPARRMAN, 1788, Mus. Carls., II, tab. 72, 73. Java.

RANGE.—From Tenasserim to the Malakka Peninsula, Sumatra, and Java.

Erythrura prasina cœlica Stuart Baker

Erythrura prasina cœlica STUART BAKER, 1925, Bull. Brit. Orn. Club, XLV, p. 84. Borneo.

RANGE.—Borneo.

Erythrura tricolor (Vieillot)

Fringilla tricolor VIEILLOT, 1817, Nouv. Dict. d'Hist. Nat., nouv. éd., XII, p. 233. Timor.

Erythrura forbesi SHARPE, 1890, 'Cat. Birds. Brit. Mus.,' XIII, p. 387. Tenimber Islands.

RANGE.—Timor, Tenimber Islands (Timorlaut, Wetter, Babber, Dammer and Roma). (See also: HARTERT, 1904, Nov. Zool., XI, p. 217; and HELLMAYR, 1914, 'Die Avifauna von Timor,' pp. 61–62.)

Erythrura papuana Hartert

Erythrura trichroa papuana HARTERT, 1900, Nov. Zool., VII, p. 7. Arfak Mts.

RANGE.—Arfak Mts. (northwest New Guinea) and Mts. of southeast New Guinea (Aroa River, Kotoi district). (See also: HARTERT, 1930, Nov. Zool., XXXVI, p. 43.)

Erythrura trichroa (Kittlitz)

RANGE.—From New Guinea westward to the Moluccas and Celebes, northward to the Bismarck Archipelago and Micronesia, eastward to the Solomon Islands, New Hebrides and Loyalty Islands, and southward to the Cape York Peninsula in Queensland.

Erythrura trichroa trichroa (Kittlitz)

Fringilla trichroa KITTLITZ, 1835, Mém. Acad. St. Petersb., II, p. 8, tab. 10. Ualan (=Kusaie), Caroline Islands.

RANGE.—Caroline Islands (Kusaie, Ponape, and Ruk). (See also: HARTERT, 1900, Nov. Zool., VII, p. 6.)

Erythrura trichroa pelewensis[1] Kuroda

Erythrura trichroa pelewensis KURODA, 1922, in Momiyama, 'Birds of Micronesia,' p. 27. Pelew Islands.

RANGE.—Pelew (or Palau) Islands.

Erythrura trichroa sanfordi Stresemann

Erythrura trichroa sanfordi STRESEMANN, 1931, Ornith. Monatsber., XXXIX, p. 12. Latimodjon Mts.

SUBSPECIFIC CHARACTERS.—Compared with *modesta* and *sigillifera:* bill thicker; green underneath lighter and more yellowish; blue on head more violet-blue; larger.

RANGE.—Latimodjon Mts. (Celebes).

Erythrura trichroa pinaiæ Stresemann

Erythrura trichroa pinaiæ STRESEMANN, 1914, Nov. Zool., XXI, p. 147. Gunung Pinaia, Seran.

SUBSPECIFIC CHARACTERS.—Differs from *modesta* by the more bluish tinge of the green above and below; edges of secondaries grayish blue, not greenish.

RANGE.—Southern Moluccas (Seran and Buru). (See also: HARTERT, 1924, Nov. Zool., XXXI, p. 111.)

Erythrura trichroa modesta Wallace

Erythrura modesta WALLACE, 1862, Ibis, p. 351. Ternate.

SUBSPECIFIC CHARACTERS.—Compared with *trichroa:* larger; under wing-coverts buffy; green of upper- and underside less deep and more yellowish.

RANGE.—Northern Moluccas (Ternate, Halmaheira, and Batjan). (See also: HARTERT, 1900, Nov. Zool., VII, p. 6.)

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[1] Doubtfully distinct from *trichroa* Kittlitz. No specimens examined.

Erythrura trichroa sigillifera (De Vis)

Lobospingus sigillifer De Vis, 1897, Ibis, p. 389 [type locality apparently Mt. Scratchley, southeastern New Guinea].

Erythrura trichroa goodfellowi Ogilvie-Grant, 1911, Bull. Brit. Orn. Club, XXIX, p. 29. Morokadistrikt, southeast New Guinea.

Erythrura trichroa macgillivrayi Mathews, 1914, Austr. Av. Record, II, p. 103. Claudie River = Lloyd's River, north Queensland.

Subspecific Characters.—Very similar to *modesta*, but the green above and below is usually less yellowish, and the blue on forepart of the head is somewhat darker.

Range.—Mountains of Cape York Peninsula (north Queensland), mountains of New Guinea (thus far found on Arfak Mountains, Schraderberg, and Peripatusberg (Sepik region), Saruwaged Mountains, Herzog Mountains, mountains of southeast New Guinea), mountains of Goodenough Island (H. Hamlin, Coll., 1928), mountains of Sudest, Dampier and Vulcan Island, mountains of New Ireland. (See also: Hartert, 1925, Nov. Zool., XXXII, p. 135 (New Ireland); idem, 1930, Nov. Zool., XXXVI, p. 43 (Arfak). Mayr, 1931, Mitt. Zool. Mus. Berlin (in press) (Saruwaged). Rothschild and Hartert, 1915, Nov. Zool., XXII, p. 36 (Dampier and Vulcan Islands); idem, 1918, Nov. Zool., XXV, p. 320 (Sudest). Stresemann, 1914, Nov. Zool., XXI, p. 147 (description); idem, 1923, Arch. f. Naturg., LXXXIX, fasc. 7, p. 48 (north New Guinea, Sepik region).)

Erythrura trichroa eichhorni Hartert

Erythrura trichroa eichhorni Hartert, 1924, Nov. Zool., XXXI, p. 274. St. Matthias Island.

Subspecific Characters.—Similar to *sigillifera*, but smaller, and blue on forehead more extended.

Range.—St. Matthias Island (Bismarck Archipelago).

Erythrura trichroa woodfordi Hartert

Erythrura trichroa woodfordi Hartert, 1900, Nov. Zool., VII, p. 7. Aola, Guadalcanar.

Subspecific Characters.—Similar to *modesta*, but frontal band narrower and wing longer.

Range.—Guadalcanar Island, British Solomon Islands.

Erythrura trichroa cyaneifrons Layard

Erythrura cyaneifrons Layard, 1878, Ann. and Mag. Nat. Hist., (5) I, p. 374. Lifu, Loyalty Islands.

Subspecific Characters.—In coloration apparently similar to *trichroa*, but by far the smallest subspecies of the species. Wing, 55–58 (56.1); tail, 41–45 (43.2); tail-wing index, 73.2–80 (76.0).

SPECIMENS EXAMINED (Whitney South Sea Expedition).—New Hebrides: Efate Island (June, July 1926), 8♂, 3♀, 9 juv.; Lopevi Island (Aug. 1926), 3♂, 2♀; Ambryn Island (Dec. 1926), 1♂; Aoba Island (Jan. 1927), 1♂, 4 juv. Banks group: Gaua Island (Sept. 1926), 1♀, 1 juv.

Formerly known from the following localities.—Loyalty Islands: Lifu and Maré (Layard). New Hebrides: Tanna (Layard), Erromango (Ramsay), Efate, and Ambrym (Farquhar).

The specimens from the different islands of the New Hebrides group and from Gaua agree perfectly with each other. But I have not seen any material from the Loyalty Islands; apparently no museum seems to have a series from that group.

(See also: SHARPE, 1890, 'Cat. Birds,' XIII, p. 386; idem, 1900, Ibis, p. 347. WIGLESWORTH, 1891, 'Aves Polynesiæ,' p. 42. HARTERT, 1900, Nov. Zool., VII, p. 7.)

Erythrura psittacea (Gmelin)

Fringilla psittacea GMELIN, 1789, 'Syst. Nat.,' I, p. 903. New Caledonia.

RANGE.—New Caledonia. (See also: SARASIN, 1913, 'Die Vögel Neu-Caledoniens,' pp. 44–47; and MATHEWS, 1930, 'Syst. Av. Australas,' p. 838.)

This species perhaps can be considered a representative of *cyanovirens* Peale.

Erythrura cyanovirens (Peale)

RANGE.—Samoa, Fiji and New Hebrides.

Erythrura cyanovirens cyanovirens (Peale)

Geospiza cyanovirens PEALE, 1848, 'U. S. Explor. Exped.,' Birds, p. 117. Upolu (Samoa).

Erythrura pucherani BONAPARTE, 1850, 'Consp. Gen. Avium,' I, p. 457. Oceania, restr. to Upolu (Samoa).

Lobiospiza notabilis HARTLAUB AND FINSCH, 1870, Proc. Zool. Soc. London, p. 817, Pl. XLIX. Upolu Island (Samoa) [description of juvenal].

CHARACTERS.—Adult and juvenal plumages are correctly described in the 'Catalogue of Birds,' so I can spare myself repetition. One of the two adult males from Upolu has the lower back, the wing-coverts, flanks and lower belly more greenish, the other specimen has these parts almost pure blue. This indicates a considerable individual variation. The specimens, collected in March and April, are either in perfectly fresh plumage or very worn and molting. These months seem to be the molting season.

MEASUREMENTS.—Wings, 62–66; tail, 30–34; bill, 9–10; tarsus, 17.

SPECIMENS EXAMINED.—Samoa Islands, Upolu (March, April 1924), 2♂ ad., 1♀ ad., 1♀ juv.; Savaii Island (May 1924), 1♂ semi-ad., 1♂ juv., 4♀ juv.

Unfortunately I have no fully adult male from Savaii. The semi-adult specimen seems to molt from the first year's plumage to the adult one, and all the fresh feathers on back and breast are pure green. I therefore consider it as probable that Savaii is inhabited by a subspecies distinguished from typical *cyanovirens* from Upolu by a more greenish color of back and breast. In the measurements there is no difference. Lack of material prevents me from describing this apparently new form.

Erythrura cyanovirens pealii Hartlaub

Erythrura pealii HARTLAUB, 1852, Arch. f. Naturg., p. 104. New name for *Geospiza prasina* Peale, 1848, 'U. S. Expl. Exped.,' Birds, p. 116. Vanua Levu, Fiji, and not *Loxia prasina* Sparrmann = *Erythrura prasina.*

RANGE.—Fiji Islands.

SPECIMENS EXAMINED (R. H. Beck, J. G. Correia, Coll.).—Fiji group: Taviuni Island (Nov., Dec. 1924), 2♂, 2 juv.; Vanua Levu Island (Dec. 1924, Jan., Feb. 1925), 2♂, 1♀, 3 juv.; Viti Levu Island (Febr.–May, Sept. 1925), 6♂, 2♀, 2 juv.; small islands west of Viti Levu (Malolo, Tavua, Yanuaya, Waia, Naviti, Yasawa) (Jan. 1925), 7♂, 3♀, 10 juv.; Kandavu Island (Nov. 1924), 6♂, 4♀, 2 juv.

	WING	TAIL
Males	57–63(59 6)	32–35
Females	57–61(59.7)	31–32

There is a great deal of individual variation that may lead to wrong conclusions, if only part of the series is represented. The major points of variation are the tinge of red on crown and tail, the extension of the black on the chin and of the blue on the breast, and size and shape of the bill. Wear changes the plumage to a considerable degree. All colors get lighter, the red on head and upper tail-coverts changes from scarlet-vermilion to scarlet-red, and the green becomes a bluish tinge. The skins collected in January, on the western islands, especially show the effects of wear.

Females are very similar to the males but not identical. The black on the throat and the blue on the breast are more reduced; the underside is lighter, especially on the flanks.

The juvenal plumages are rather puzzling. The adult plumage is acquired by a complete molt. Of birds with a juvenal plumage we find different types: some have the crown green, and cheeks and throat pale bluish-green, others are very similar, but have the cheeks rather dark bluish and the forehead and parts of the crown more or less distinctly bluish (*a*-type of juvenal plumage); while other specimens have narrow reddish edges on the feathers of the forehead and sometimes also on cheeks and ear-coverts (*b*-type of juvenal plumage). These latter specimens sometimes have a more compact plumage than the other juvenal specimens.

Investigating molting specimens I found that birds of both types of juvenal plumage (*a* and *b*) molt directly into the adult plumage. So we must assume that both are equivalent, and that the species has a wide range of individual variation in the juvenal plumage, which is sometimes more primitive and sometimes more approaching the adult style of coloration.

Erythrura cyanovirens regia (Sclater)

Erythrospiza regia Sclater, 1881, Ibis, p. 544, Pl. xv, fig. 2. Apı (=Epi) Island, New Hebrides.

Measurements.—Males and females: wing, 62–67; tail, 34–37.

Range.—Northern New Hebrides and Banks Islands.

Specimens Examined.—Northern New Hebrides: Mai Island (July 1926), 6♂, 2♀; Tongoa Island (July 1926), 14♂, 4♀, 2 juv.; Lopevi Island (August 1926), 4♂, 2♀, 1 juv.; Pauuma Island (August 1926), 9♂, 4♀. Banks Islands, Gaua Island (Sept.–Nov. 1926), 4♂, 3♀.

There is no difference, in size or coloration, between the specimens from the northern New Hebrides and those from Gaua Island. The Gaua specimens, collected later in the season, are more worn, and have, therefore, the red on head and upper tail-coverts slightly lighter and more scarlet.

Females differ from males by having flanks, lower back, wing-coverts, and edges of secondaries greenish.

Erythrura cyanovirens efatensis, new subspecies

Type.—No. 213017, Amer. Mus. Nat. Hist.; ♂ ad.; Efate Island, New Hebrides June 30, 1926; R. H. Beck and J. G. Correia.

Subspecific Characters.—Similar to *serena* Sclater from Aneiteum, but distinguishable by the darker red on head and upper tail-coverts and by the smaller size.

	WING	TAIL
16♂ ad.	61–64(63.1)	34–36(35.1)
2♂ juv.	60, 63	28, 33
7♀ ad.	62–65(63.0)	33–35(34 2)
1♀ juv.	62	32

FEMALE.—Very similar to the male, but lighter in all colors, especially the blue on the breast which is much less deep.

RANGE.—Efate Island, New Hebrides.

Unfortunately, the American Museum does not possess any material from Aneiteum, the type-locality of *serena*. Considering the distance between Efate and Aneiteum I expected some difference between the specimens and sent some Efate material to the British Museum, where Mr. N. B. Kinnear compared it with the typical material. I am greatly obliged to Mr. Kinnear for his ready help and extensive notes which follow:

"According to Sclater, Ibis, 1881, p. 544, J. MacGillivray obtained four examples of *Erythrura serena* in Aneiteum on 8th February. Unfortunately Gray removed the original labels, when the specimens were purchased from Cumming, and the register does not supply the sexes of the two adult birds.

"In addition apparently MacGillivray obtained a fifth example also on 8th February, and this was purchased by Eyton and, after passing into Gould's collection, came here and still has its original label.

"The details of our five specimens are as follows:—
1861.6.15.2 adult (8th Feb. 1860) Aneiteum. Type.
1861.6.15.4 adult (8th Feb. 1860) Aneiteum.
1861.6.15.5 juv. male Aneiteum. (Assuming adult plumage.)
1861.6.15.3 juv. male from nest, 8th Feb. 1860.
1881.5.4473 female adult, 8th Feb. 1860, Aneiteum, ex Eyton Coll.

"Iris dark umber, tarsi and toes dusky flesh-color. All the skins are in good condition, the head of the female is in moult and only partially red.

"Your series is distinguishable from ours by the colour of the head and upper tail coverts, which are darker than the Aneiteum birds, as is shown in our copy of the plate in the 'Ibis'. In other words, the Aneiteum bird has a scarlet head and the Efate a scarlet-vermillion head.

"The blue on the throat and breast is intermediate between your 21255 and 21225 and the other three specimens.

Wing Measurements

(A. M. N. H.)	Male 63, 64, 62. mm.. Female, 62, 65.
(B. M.)	? 67, 67. mm. Female 66."

I do not rely too much on the coloration of the head, as the typical specimens of *serena* were collected in February and therefore possibly are in rather worn and bleached condition. But the size distinguishes both forms satisfactorily. There is possibly another difference: most of the adult males of *efatensis* have broad blue edges to the lesser wing-coverts; these parts seem to be green in typical *serena* according to the original description and the plate in Ibis, 1881.

Erythrura cyanovirens serena (Sclater)

Erythrospiza serena SCLATER, 1881, Ibis, p. 544, Pl. XV, fig. 1, Aneiteum Island.

RANGE.—Aneiteum Island, southern New Hebrides.

See *E. c. efatensis* (p. 9).

RHAMPHOSTRUTHUS, new subgenus

SUBGENERIC CHARACTERS.—Bill very strong, without a ridge on the upper or lower mandible, not laterally compressed near the tip. Plumage very dense and compact, on the forehead more velvety; tail only slightly graduated; central tail-feathers not distinctly longer than the lateral; wing round.

TYPE.—*Amblynura kleinschmidti* Finsch.

Erythrura kleinschmidti (Finsch)

Amblynura kleinschmidti FINSCH, 1878, Proc. Zool. Soc. London, p. 440, Pl. XXIX, Viti Levu.

RANGE.—Viti Levu Island, Fiji Islands.

SPECIMENS EXAMINED.—Viti Levu and Suva, Viti Levu (Fiji Island) (June 1924, Dec. 1924, April, May 1925): 6♂, 1♀ (?), 1 semi-adult.

	WING	TAIL
6♂	65–69(66.5)	34–37(35 6)
♀ (?)	69	..
semi-ad.	68	34

One bird is sexed as female, but in coloration it is like the males. The semi-adult bird molts from the juvenal to the adult plumage. The juvenal plumage seems to be characterized by the duller coloration of upper- and underside, by having less black on the head, and by being more brownish instead of yellowish olive on the sides of the neck and breast.

It is amazing that this most aberrant species of the genus had not been separated generically, thus far. The rarity of the species in collections may account for this.

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ROCKY MOUNTAIN BEES. III[1]

By T. D. A. Cockerell and Ruth Sumner

THE GENUS *HYLÆUS* (*PROSOPIS*)

The name *Hylæus* was proposed by Fabricius in 1793 for a series of small bees, including what became later known as *Prosopis*, and also *Halictus*. Hence it resulted that some authors applied the name to *Prosopis*, others to *Halictus*, and in recent years the tendency has been to discard it altogether. Förster, in his elaborate 'Monographie der Gattung *Hylæus* F. (Latreille),' published in 1871, uses the older name in the sense of *Prosopis*, and Meade-Waldo, in the 'Genera Insectorum' (1923) also uses *Hylæus* in the same sense, remarking that Latreille (1802) fixed *Hylæus annulatus* as the type. Förster, in a footnote, remarks that the name *Prosopis* is objectionable, because already employed for a well-known genus of plants. That this argument is not without point is shown in Rivnay's recent 'Revision of the Rhipiphoridæ of North and Central America' (1929), where (p. 26) *Macrosiagon flavipenne* is said to have two recorded hosts, *Prosopis glandulosa* and *Bembex spinolæ*. The author was evidently not aware that the first name was not that of a bee, but of the mesquite on which the beetle happened to be found.

Förster's elaborate treatment of the Palæarctic species, including full descriptions and carefully constructed tables, appears at first sight to leave little to be desired. The fully recognized species number ninety-four, and there are thirteen others concerning which the author lacks sufficient information. Later writers, however, have consistently found fault with Förster's treatment, reducing many of his names to the synonymy. Meade-Waldo (1923) summarizes the results of this destructive criticism, wherein, for example, no less than fifteen Förster "species" are placed under *H. brevicornis* Nylander. These are admitted not to be exactly alike, and are placed in three groups: *brevicornis* proper, variety *imparilis* (Förster), and variety *kahri* (Förster). Some of Förster's names, as *H. prænotatus* and *H. marginatus*, remain in the list, not because they are known to be valid, but because they could not be found in Förster's collection, and are not known, as synonyms or otherwise, to modern writers. Alfken (Abh. Nat. Ver. Bremen, 1904) gave a detailed account of Forster's collection, setting forth the synonymy as he understood it. In Meade-Waldo's list there are one hundred and fifty-eight species of Palæarctic *Hylæus* treated as distinct. Since then, five species and a race have been added by Alfken, and fourteen species from eastern Siberia (Maritime Province) were published in 1924 by Cockerell. There is also *Hylæus atrocallosus* (Morawitz), from Turkestan, accidentally omitted by Meade-Waldo. Thus the matter stands at present, but adequate structural studies of the Palæarctic species have not yet been made, and it is not improbable that a future reviser, with more adequate collections, will greatly transform the aspect of the list.

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[1] Nos. I and II of this series appeared in American Museum Novitates Nos. 433 and 458, respectively.

For the Nearctic region, Meade-Waldo cites forty-two species, and a considerable number of varieties. Since then, a species (*H. sonorensis* Cockerell) from Sonora and one (*H. giffardiellus* Cockerell) from California have been added. The foundation for all modern studies of Nearctic *Hylæus* is the great work of Charles W. Metz 'A Revision of the Genus *Prosopis* in North America' (Trans. Amer. Ent. Soc., 1911). This paper, when it appeared, created a certain amount of prejudice by its dogmatic style, and subsequent studies indicate that in several cases Metz was too hasty in reducing names to the synonymy. Nevertheless, all things considered, it is an extremely valuable work, no doubt the best ever done on the genus. From the standpoint of general biology, it may have been the best thing for Metz to drop the study of bees and take to genetics; but students of bees can only regret that he did not continue what he had so well begun.

The study of the Rocky Mountain collections obtained by Dr. Frank E. Lutz serves to confirm the view that most of the species are already known. Whereas in *Halictus*, *Andrena*, and some other large genera, new species are continually coming to light, the *Hylæus* fauna in North America seems rather limited. Certainly it is not so rich or varied as in some other parts of the world. The few new species obtained by Dr. Lutz are all very small, and perhaps they are not so rare as now appears, for they can, like *Perdita*, pass readily through the ordinary net, and escape. In the case of *Perdita*, this difficulty is usually overcome by the large number of specimens present, so that several are likely to be captured, but this would not be true in the case of *Hylæus*.

The specimens were all taken by Dr. Lutz, unless the contrary is stated, and will be found in the collection of The American Museum of Natural History, where the Metz collection is also preserved.

Hylæus verticalis (Cresson)

Prosopis tridentula Cockerell, male, was said to differ from *P. verticalis* by the shorter antennæ and first recurrent nervure entering second cubital cell. The type is from Chamber's Lake, Larimer County, Colorado, 9500 ft. altitude.

In Cockerell's (1898) key in Entomologist, XXXI, p. 186, we find:

First abdominal segment smooth; end of lateral face-marks above on a smooth shining space *verticalis.*
First abdominal segment punctured.
  Somewhat larger, face broader, face-marks creamy white *tridens.*
  Somewhat smaller, face narrower, face-marks strongly yellow *tridentula.*

Metz subsequently dissected males of *H. tridens* Cockerell and found them structurally identical with *H. tridentulus,* and his conclusion that they represent one species appears justified.

The senior author had for some time past differed from Metz's interpretation of the female of *H. varifrons,* referring to that species specimens which Metz had as "possible" *tridentulus,* and placing under *verticalis* essentially the same thing as the *varifrons* of Metz. However, among the specimens studied by Metz are males and females from Florissant, Colorado, and Beulah, New Mexico. The males are perfectly typical *H. varifrons* (Beulah) and *H. tridentulus* (Florissant). In the male *varifrons* the sides of the first tergite have very well-separated punctures, and little punctures between, and the sides of the second tergite have very small punctures; the wings are very brown. In the male *tridentulus* the sides of the first two tergites have much stronger, round punctures; the lateral hind margins of the first two tergites show white hair (wholly lacking in *varifrons*); the wings are clear. In the female from Beulah there are very delicate punctures on sides of first two tergites; no white hair at lateral apices of tergites; wings brownish. In the female from Florissant the punctures at sides of tergites are stronger, and the white hair is very evident. There can be no doubt that these females belong to the males, and for purposes of rapid recognition it must be noted that the lateral face-marks of *tridentulus* are broader, and turn inward (away from eyes) at the upper end.

The senior author received a letter from Mr. J. C. Crawford, dated March 30, 1917, containing the following information: "Yesterday I made a very interesting discovery in the genus *Prosopis.* I have from around here specimens of Cresson's species *verticalis,* and upon dissection of the male find that the characters are identical with what Metz publishes as your species *tridentulus.* So far I have not made a careful examination of your type, which is in our (U. S. Nat. Museum) collection, but superficially the two forms seem to differ only in size."

The conclusion must apparently be that *H. verticalis* is the correct specific name for this insect; but probably the Rocky Mountain form deserves to stand as a subspecies, *H. verticalis tridentulus.*

COLORADO.—Males: Boulder, May 23, 1913, at privet; Cornet Creek, Telluride, July 9, 1919, alt. about 10,000 ft.; Ward, July 7, 1922, G. W. Strawbridge, collector. Females: Boulder, June 18, 1922, at *Scrophularia occidentalis;* Boulder, May 24, 1918, at *Oreobatus deliciosus;* Longs Peak Inn, July 14 (Cockerell); Ouray, July 11–14, 1919, alt. about 8400 ft.; Starkville, June 13, 1919, alt. about 6800 ft.

WYOMING.—Female: Stewart Ranger Station (Jackson Hole district), July 18, 1920, alt. about 6700 ft.

Hylæus ellipticus Kirby

It now appears certain that *Prosopis varifrons* Cresson, 1869 (type from Colorado) must be included in *H. ellipticus.* Lovell (Psyche, October, 1910) separates the females thus:

Tegulæ spotted, marks nearly white.............. ....*varifrons.*
Tegulæ dark, marks pale yellow... . ...*elliptica.*

He describes both as having a transverse mark on clypeus. Cresson states that *varifrons* female sometimes had a transverse stripe on clypeus.

In the Entomologist (1898) key, Cockerell separated the females thus:

Collar all dark (excluding tubercles), markings yellow, clypeus all dark....*varifrons.*
Collar partly light, a light band on lower edge of clypeus..*ellipticus* (from Canada).

No Colorado specimens referred to *H. ellipticus* have the collar (upper border of prothorax) all dark; Lovell describes it as all dark in the females of both species. Seven Colorado females have the transverse mark on clypeus distinct but variable. Three Colorado females (Tennessee Pass, Leadville, Ouray) have the transverse mark reduced to a couple of dots, representing its ends. One from the Yellowstone National Park, Wyoming, is similarly marked. Three Colorado females (Tennessee Pass and Lawn Lake) have the clypeus all dark. All these have spots on the tegulæ; but one female (Longs Peak Inn, Colorado, July, Cockerell) has a black clypeus and entirely black tegulæ.

It is probable that the common Colorado insect may be recognized as a race, *Hylæus ellipticus varifrons,* with light spots on the tegulæ, and typically with no light band on the clypeus. *H. ellipticus* was originally based on the female, from far north in British America, and it is unfortunate that no males are available from that region. The color of the face-markings varies from yellow and whitish in females from Ward and Electra Lake; it is evidently not reliable for specific distinction.

Colorado.—Males: Aspen, July 24–27, 1919, alt. about 11,000 ft.; Boulder, May 24, 1913, on *Hydrophyllum fendleri*, Ellis Collection; Electra Lake, June 28–July 1, 1919, alt. about 8400 ft.; Ouray, July 11–14, 1919, at *Achillea millifolium*, alt. about 8500 ft ; Rifle, July 19–21, 1919, alt. about 5400 ft.; South Fork, June 17, 1919, alt. about 8200 ft.; Ward, August 8–10, 1919, June 25, 1922, July 7, 1922, alt. about 9300 ft. Females: Electra Lake, June 28–July 1, 1919, alt. about 8400 ft.; Lawn Lake, Rocky Mt. Nat. Park, August 22, 1919, H. F. Schwarz, collector; Leadville, August 3–5, 1919, alt. about 10,200 ft., H. F. Schwarz, collector; Longs Peak, June 14–19, 1922, alt. about 9000 ft.; Ouray, July 11–14, 1919, alt. about 8500 ft.; Tennessee Pass, August 6–8, 1920, alt. about 10,500 ft.; Ward, August 8–10, 1919, June 25, 1922, alt. about 9300 ft.

Wyoming.—Males: Stewart Ranger Station (Jackson Hole district), July 18, 1920, Mrs. F. E. Lutz, collector. Females: Near Old Faithful, Yellowstone National Park, July 24–25, 1920, alt. about 7500 ft.

Hylæus basalis (Smith)

Colorado.—Males: Boulder, June 20, 1922, June 6, 1922, alt. about 5600 ft., Frank B. Lutz, collector; Ward, June 25, 1922, alt. about 9300 ft., Frank B. Lutz, collector. Females: Aspen, July 24–27, alt. about 8500 ft., H. F. Schwarz, collector; Electra Lake, July 1, 1919, at *Potentilla filipes*, alt. about 8400 ft.; Ouray, July 11–14, 1919, alt. about 8500 ft.; Ward, June 25, 1922, at dandelion, alt. about 9300 ft.

Wyoming.—Females: Camp Roosevelt, Yellowstone Park, July 14–17, 1923.

Hylæus cressoni (Cockerell)

Colorado.—Males: Boulder, August 7–12, 1919, at *Solidago*, alt. about 5500 ft.; Meeker, July 20–21, 1919, alt. about 6200 ft.; Monte Vista, June 16, 1919, alt. about 7600 ft.; Wray, August 17–19, 1919, alt. about 3700 ft. Females: Boulder, May 23, 1913, Ellis Collection; Boulder, August 7–12, 1919, at *Solidago*, alt. about 5500 ft.; Boulder, June 18, 1922, at *Scrophularia occidentalis;* Glenwood Springs, August 5, 1920, alt. about 5800 ft.; Jim Creek, near Boulder, July 8–11, 1922, alt. about 6400 ft., Mrs. F. E. Lutz, collector; Tennessee Pass, July 30–August 2, 1919, alt. about 10,300 ft.; Wray, August 17–19, 1919, alt. about 3700 ft.

Idaho.—Females: Giveout, July 7, 1920, alt. about 6700 ft., Mrs. F. E. Lutz, collector.

Utah.—Males: Ogden, August 29–30, 1916.

Wyoming.—Females: Green River, July 2, 1920, alt. about 6100 ft.

Hylæus mesillæ (Cockerell)

Four Colorado females certainly belong here. We had to consider whether they could be *H. magniclavis* (Swenk and Cockerell), a species from the Bad Lands of Nebraska, which might be expected in Colorado; but the basitarsi are clear yellow or whitish, whereas in *H. magniclavis* they are largely dark. The face-marks are also a little different, but variable.

Colorado.—Females: Boulder, May 22, 1913, at *Bursa bursa-pastoris;* Boulder, August 7–12, 1919, at *Solidago*, alt. about 5500 ft.

Hylæus modestus (Say)

We have a considerable series of females in the Lutz collection but no males. All have much yellow on collar, so they are not of the species or form *H. citrinifrons* Cockerell. They do, however, agree with the description of *Prosopis nucleolus* Viereck, from Beulah, New Mexico, and must certainly belong to that form. It is not apparent at present how this supposed species can be definitely separated from *H. modestus*.

All lack a yellow mark on base of wing; some (Jim Creek, South Fork of Rio Grande, Aspen, Colorado: and Stewart Ranger Station, Wyoming), lack the spot on tegulæ, but others (Electra Lake and Pagosa Springs) have spotted tegulæ.

COLORADO.—Females: Aspen, July 24–27, 1919, alt. about 8500 ft.; Electra Lake, June 28–July 1, 1919, alt. about 8400 ft.; Jim Creek, near Boulder, July 21–23, 1922, at *Œnothera*, alt. about 6400 ft.; Pagosa Springs, June 22–24, 1919, alt. about 7200 ft.; South Fork of Rio Grande, July 18–19, 1919, alt. about 9200 ft.

WYOMING.—Females: Stewart Ranger Station (Jackson Hole district), July 18, 1920, alt. about 6700 ft.

Hylæus coloradensis (Cockerell)

We have both sexes. The females, with broad face and reduced lateral face-marks, agree with Metz's account. *H. tuertonis* (Cockerell), from Tuerto Mountain, New Mexico, is a smaller species, with narrower face, the lateral marks very pale. It must be distinct, and not the female of *coloradensis* as has been supposed.

COLORADO.—Male: Boulder, May 29, 1922, at *Erigeron*, alt. about 6400 ft.; Jim Creek, near Boulder, September 2, 1922, alt. about 6400 ft.; Longs Peak Inn, June 16, 1922, alt. about 9000 ft. Female: Ouray, July 11–14, 1919, alt. about 8300 ft.; Tennessee Pass, August 6–8, 1920, alt. about 10,500 ft.

UTAH.—Female: Ogden, July 25, 1920, alt. about 4300 ft.

Hylæus gaigei (Cockerell)

Female with wholly black face.

UTAH.—Ogden, July 25, 1920, alt. about 4300 ft.

Hylæus wootoni (Cockerell)

Many females. Distinguished from *H. rudbeckiæ*, as Metz indicates, by the conspicuously and strongly punctured first tergite. They are female *H. wootoni* in the sense of Metz, who included *H. divergens*. The name *H. wootoni* was originally based on the male.

COLORADO.—Females: Estes Park, July 19, 1916, August 13–19, 1919; Jim Creek, near Boulder, July 21–23, August 3, 1922, alt., about 7000 ft.; Ouray, July 11–14, 1919, alt. about 8400 ft.; Regnier, June 6–9, 1919, alt. about 4400 ft.; Schmoll's Ranch near Ward, July 3, 1922, G. W. Strawbridge, collector.

UTAH.—Females: Ogden, August 29–30, 1916, July 25, 1920, alt. about 4300 ft.

Hylæus rudbeckiæ (Cockerell and Casad)

Some of the specimens have the characters of the form *ruidosensis* Cockerell, but it is probably not a distinct race.

COLORADO.—Males: Boulder, June 6, 1922, alt. about 6900 ft.; Boulder, June 20, 1922, "Dancing" over the moist bank of a brook, alt. about 5600 ft.; Ward, June 25, 1922, alt. about 9300 ft. Females: White Rocks, near Boulder, August 13, 1919, alt. about 5200 ft.

UTAH.—Males: Huntsville, July 26, 1920; Ogden, August 29–30, 1916. Females: Ogden, August 29–30, 1916.

WYOMING.—Female: Green River, July 2, 1920, alt. about 6100 ft.

Hylæus episcopalis (Cockerell)

COLORADO.—Males: Boulder, June 7, 1922, June 20, 1922, alt. about 6000 ft.; Frank B. Lutz, collector.

IDAHO.—Males: Bear Lake, July 9, 1920, alt. about 6200 ft.; Moscow Mts. July 8, 1898.

Hylæus stevensi (Crawford)

These males do not agree with Crawford's figure (Canad. Entomologist, May, 1913), having the upward extension of the lateral marks much narrower, but they do agree substantially with a specimen received from Crawford, collected at Fargo, North Dakota, the type locality.

The face-markings quite closely resemble those of *H. modestus* variety *minyra* (Lovell), as figured by Metz.

COLORADO.—Male: Glenwood Springs, August 5, 1920, alt. about 5800 ft.

IDAHO.—Male: Bear Lake, July 9, 1920, alt. about 6200 ft.

UTAH.—Male: Provo, July 29–August 1, 1920, alt. about 4500 ft.

WYOMING.—Male: Green River, July 2, 1920, alt. about 6100 ft

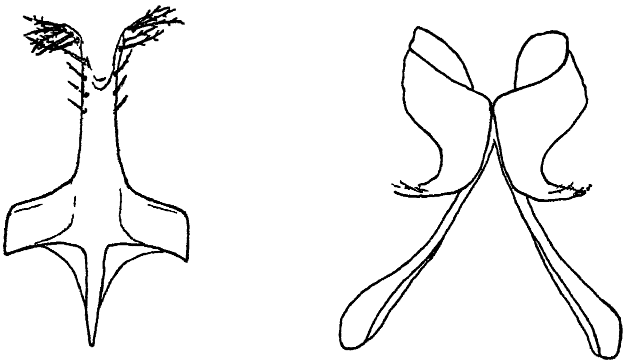
Hylæus dunningi (Cockerell)

The known range is greatly extended by a male and two females from Utah. One of the females has the tegulæ spotted, the other not.

UTAH.—Male: Provo, August 1, 1920. Female: Provo, July 20–August 1, 1921, alt. about 4500 ft., Mrs F. E Lutz, collector.

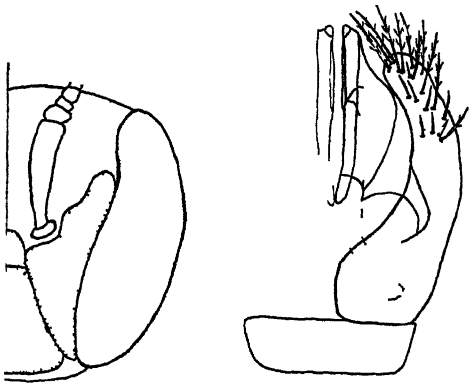
Hylæus divergens (Cockerell)

Although Metz was convinced that this species could not be separated from *H. wootoni*, we believe it to be a valid, though closely allied, species. In the male genitalia the sagittæ extend well beyond the stipites; and externally the species can be recognized by the smaller size, spotted tegulæ, and the form of the lateral face-marks. In *H. wootoni* the upper extension of the lateral face-marks is elongate, with its inner border distinctly concave, whereas in *H. divergens* the inner border is convex. The color of the face in *divergens* is typically very pale, creamy white. The Arizona specimens noted below have the face a shade yellower, but this is unimportant. So far as we know, *H. divergens*



Eighth Ventral Plate

Seventh Ventral Plate



half of Face

Half of Male Genitalia

Fig. 1. Face-Marks and abdominal structures of *Hylæus divergens* from Bear Wallow, Arizona.

extends from Monroe Canyon, Sioux County, Nebraska (R. W. Dawson) to Arizona. It ascends to at least 9000 ft. in the mountains (Ute Creek, Colorado, L. Bruner). We are not at present able to say how the female may be distinguished from that of *H. wootoni*. However, we have one female which doubtless should be *divergens*. It was taken at the same time and from the same place as the males and has the tegulæ with light spots. From analogy with other species, the spotting of the tegulæ is presumably not a valid specific character.

Arizona.—Males and female: Bear Wallow, Santa Catalina Mts., July 12–17, 1916, alt. about 8200 ft.

Hylæus conspicuus (Metz)

Metz described this species from Ormsby County, Nevada (type locality), and California. A female from Jackson, Wyoming, July 15, 1920, alt. about 6300 ft., greatly extends the known range. Compared with a female from California, and with the figure given by Metz, the clypeal mark is greatly reduced, but it does not seem possible to separate it as a race, since Metz says merely "spot on clypeus usually present."

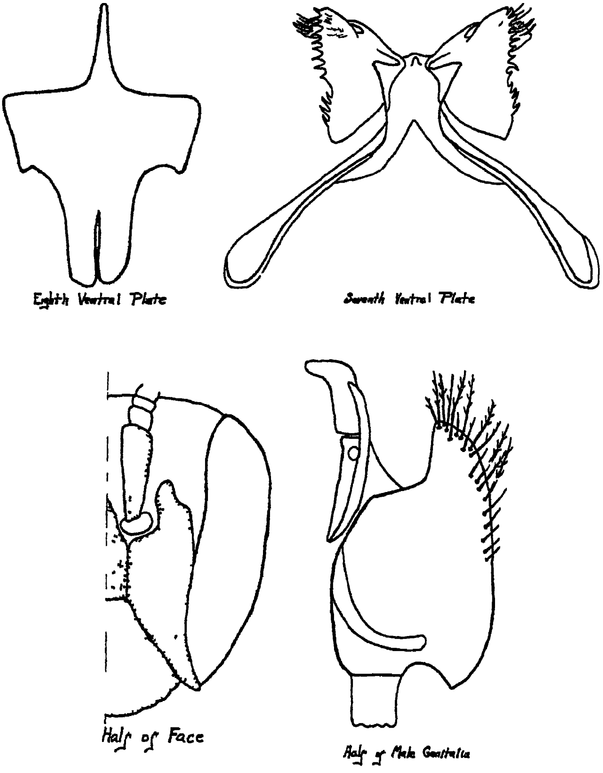
Hylæus laciniatus, new species

Male.—Length about 4.5 mm.; slender. Black, with light markings creamy white, consisting of entire face below antennæ, long supraclypeal mark extending well above antennæ and ending in a point on front; lateral face-marks ending at about same level as supraclypeal mark, obliquely truncate with point mesad, and whole upper extension distinctly separated from the orbit; scape light in front. Third antennal joint very short, nearly twice as broad as long; fourth longer but still short; flagellum rather long, pale, ferruginous beneath. Mandibles black, slightly reddish at apex; labrum black. Tubercles with light spot; tegulæ dark brown with a faintly indicated spot; base of wing with a light mark. Cheeks weakly punctate and strongly striate; front coarsely punctate and strongly striate between punctures, Mesothorax shining but not polished, with rather strong but well-separated punctures. distance between them on the disk about equal to a puncture width; scutellum broad and flattened, the punctures rather large but not so large as on hind part of mesothorax; postscutellum minutely roughened; area of metathorax broadly semilunar, strongly irregularly sculptured, with more or less anastomosing longitudinal rugæ; the intervals shining and crossed by very fine plicæ; mesopleura sparsely punctate and the lower part with long glistening white hairs; the whole thorax being rather hairy for *Hylæus*. Anterior knees and tibiæ in front, and middle tibiæ in front, and middle tibiæ at apex and base, and anterior and middle basitarsi creamy white; small joints of these tarsi becoming pale-reddish apically; hind tibiæ with nearly basal half and hind basitarsi and two following joints creamy white, but last two joints brown. Wings hyaline, stigma and nervures brown, basal nervure falling just short of nervulus; both recurrent nervures meeting the intercubitals; hind wing with five hooks. Abdomen brownish, smooth, very sparsely and weakly punctured, punctures on first tergite distinct under microscope and widely spaced; tergites with very fine transverse lineolation; no hair-bands or patches.

Colorado.—Boulder, May 24, 1913 (F. E. Lutz).

The eighth ventral plate does not resemble any species diagrammed by Metz or Crawford. The body is broad; the basal pedicel seems to be split in two parts and is almost as broad at the distal portion as at the base. The apical portion is not lobed but tapers slightly from the body outward.

The seventh ventral plate most nearly resembles *H. grossicornis.* The proximal arms extend out farther from the median line, giving it a much broader aspect than that of *H. grossicornis.* The length of the toothlike projections on the wings does not gradually diminish as the wings approach the proximal arms.



Eighth Ventral Plate

Seventh Ventral Plate

Half of Face

Half of Male Genitalia

Fig. 2. Face-marks and abdominal structures of *Hylæus laciniatus.*

The stipites are very broad and the apical portion is not particularly tubular. The sagittæ are much longer than the stipites. The genitalia more nearly resemble those of *H. conspicuus* than any other.

Hylæus perparvus, new species

Male.—Length about 4 mm. Black with light markings dull, pale yellowish, almost ochreous. Face not conspicuously broadened above as in *H. seclusus,* face all light below antennæ except that supraclypeal mark is triangular, its apex at about lower level of antennal sockets, leaving a wedge-shaped black space on each side; lateral marks broad in middle, the width somewhat greater than that of supraclypeal area, tapering above to end before middle of front rather obtusely and at extreme apex a little away from orbit. Scape short, stout, finely rugose, without light markings; flagellum dull ferruginous beneath; labrum, mandibles, and extreme lower margin of clypeus black; front punctured, and with a strong, conspicuous and shining median sulcus. Two lines on upper border of prothorax, small spot on tubercles and spot on tegulæ light; mesothorax minutely rugose, closely punctured, punctures on disc separated much less than width of punctures. No light spot on base of wing. Scutellum sculptured like mesothorax but punctures larger and not so dense; post-scutellum rugose; area of metathorax rugose, minutely longitudinally plicate, the plicæ irregular and often not parallel; mesopleura finely rugose and well punctured. Anterior tibiæ light in front, anterior tarsi brown; middle tibiæ with

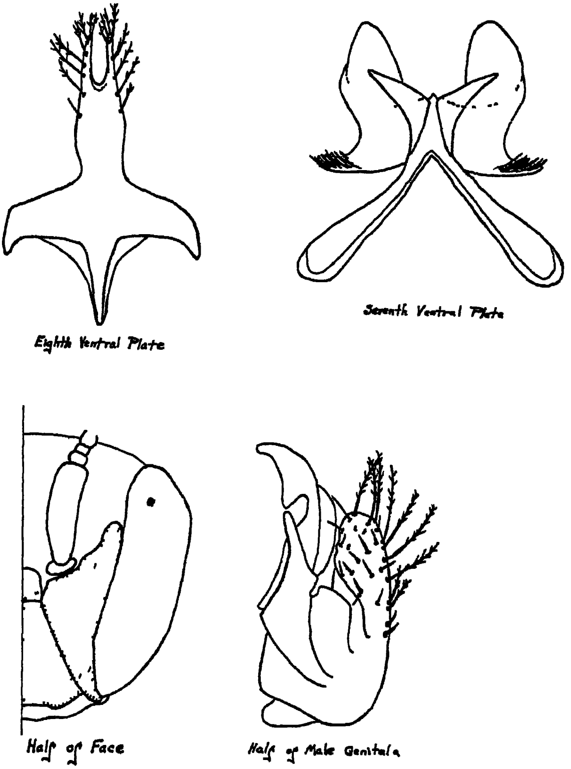


Fig. 3. Face-marks and abdominal structures of *Hylæus perparvus*.

light spot at base and not at apex; hind tibiæ with about two-fifths of base light; middle and hind tarsi with basitarsi creamy white, but with apex of basitarsi rather brown. Abdomen shining with minute sparse punctures visible under binocular.

COLORADO.—Estes Park, July 19, 1916, F. E. Lutz, collector.

The eighth ventral plate very much resembles *H. cookii* except that the basal pedicel is a little stouter near the base and tapers to the apices, while this is not so in *H. cookii.*

The seventh ventral plate most nearly resembles that of *H. polifolii.* The lobes of the wings are not so narrow and are not so long as *H. polifolii.* The wings are not constricted at the base of the lobes, and the membranous flaps are more rounded, not so elliptical as in *H. polifolii.*

The sagittal rods protrude some distance beyond the apical portions of the stipites, and are curved inward toward the center. The apical portion of the stipites does not taper, but instead is broader at the apices than at the base. Tiny hairs extend about half-way down the stipites.

Hylæus seclusus, new species

MALE.—Length about 5 mm. Black; head and thorax dull, abdomen brilliantly shiny; wings slightly brownish; light markings dull yellowish-white. Face of type slightly reddened by cyanide; orbit strongly converging below so that the face rapidly broadens above; face all light below antennæ; supraclypeal mark pointed, but little elongated above, though longer than broad; lateral marks going about half-way up front, broad, obliquely truncate, with apical point on orbital margin; mandibles and labrum black. Scape all black and rather thick, expanded at apex, minutely and densely rugose; flagellum bright ferruginous beneath. Front densely and finely punctured. Two marks on upper part of prothorax and rather small spots on tubercles light; tegulæ dark brown without any light mark; mesothorax densely punctured, rugose between punctures which on disc are separated by less than a puncture width; scutellum finely punctured; area of metathorax large, pointed behind, the apical angle about a right angle, the surface with fine irregular plicæ forming a reticulation; mesopleura minutely rugose and quite closely punctured; hair of thorax scanty. Anterior tibiæ with about basal three-fifths light in front, knees dark, anterior tarsi brown; middle knees also dark, middle tibiæ with a light spot at base but not at apex, middle tarsi with basitarsi creamy white except at apex; hind tibiæ with at least basal two-fifths light. Nervures and stigma dark brown, basal nervure falling a considerable distance short of nervulus. Abdomen polished, with fine distinct punctures; no distinct hair-bands or spots.

COLORADO.—Ouray, July 11–14, 1919, alt. about 8500 ft., F. E. Lutz, collector.

The eighth ventral plate does not closely resemble any illustrated by Metz. The apical lobes are stouter in the middle region and taper to the apices. The body is somewhat triangular in shape and the basal pedicel is narrow and pointed.

The seventh ventral plate most nearly resembles the diagram of *H. polifolii*. The distal portion of the proximal arms is not the same shape and the lobes of the wings do not extend out as far as do those of *H. polifolii*.

The transparent base of the genitalia resembles that of *H. wootoni* in shape. The sagittæ do not resemble this form, but closely resemble the sagittæ of *H. tridentulus*.

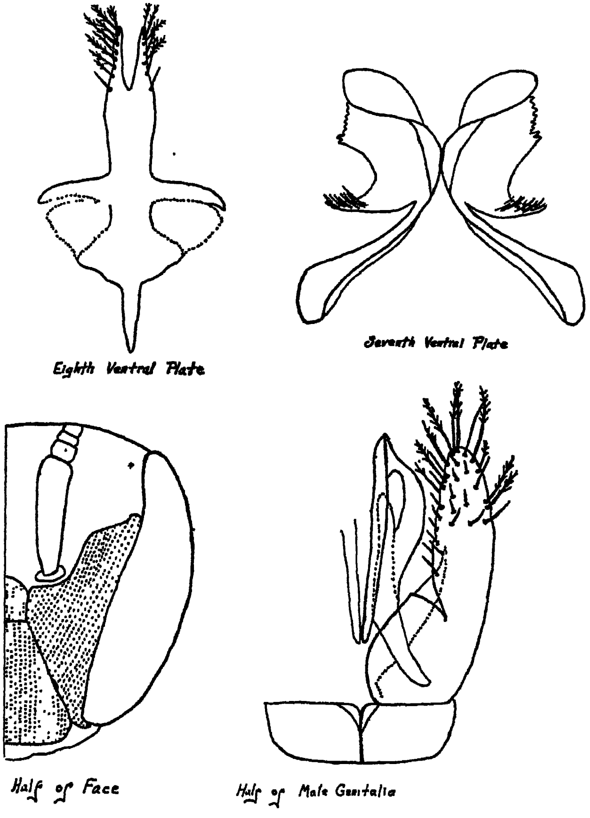


Fig. 4. Face-marks and abdominal structures of *Hylæus seclusus*.

Hylæus repolitus, new species

Female.—Length a little over 5 mm.; rather robust. Light markings creamy white; face broad, clypeus entirely black; lateral marks narrow, not extending above lower level of antennæ, clypeus glistening, minutely striate, weakly punctured; supraclypeal area similarly striate with a row of punctures on each side; front finely punctured with a median impressed line; facial foveæ narrow, bordered outwardly by a shining line, not nearly reaching lateral face-marks. Mesothorax and scutellum conspicuously shining, with fine very distinct punctures; upper border of prothorax black, but tubercles broadly light; tegulæ with a small spot; postscutellum large, finely punctured; area of metathorax large, convex, very finely lineolate and rugulose at base but remarkably free from sculpture, having no longitudinal plicæ; mesopleura with widely spaced punctures on a finely rugose surface. Wings slightly dusky; stigma and nervures brown; basal nervure meeting nervulus a little on outer side; first recurrent nervure joining second cubital cell near base; five hooks on hind wing. Legs black; tarsi dark brownish; hind tibiæ pale at base. Abdomen shining, hind portion finely hairy and having only very minute piliferous punctures; middle of first tergite impunctate, though there are distinct punctures laterally.

UTAH.—Ogden, July 25, 1920, alt. about 4300 ft., F. E. Lutz, collector.

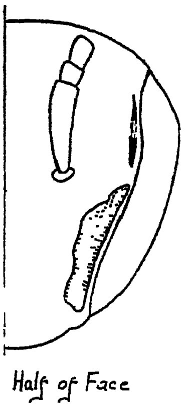


Fig. 5. Face-marks of *Hylæus repolitus*, female.

This species is readily known by the conspicuously shining mesothorax and scutellum, and the character of the metathorax. The face-marking is similar to that of *H. coloradensis* as figured by Metz, but that species has a broader face, the face-marks are less parallel, and the mesothorax is entirely dull.

The great difficulty in dealing with Rocky Mountain *Hylæus* has to do with the identification of the females. For ready reference, the following tabulation will be of some service.

1.—Face all black..2.
Face not all black..4.
2.—Large; anterior wing about 6.5 mm. long; wings brownish; no light marks on thorax........................*basalis* Smith.
Much smaller..3.
3.—No light marks on thorax; wings clear................*personatellus* Cockerell.
Tubercles and upper border of prothorax marked with pale yellow; wings brownish........................*gaigei* Cockerell.
4.—Clypeus with light marking..5.
Clypeus all black..7.
5.—Lower margin of clypeus with a transverse light mark, sometimes reduced to a pair of dots........................*ellipticus* Kirby.
Clypeus with a longitudinal light mark..6.
6.—Rather large species, about 6 to 7 mm. long................*conspicuus* Metz.
Very small species; basitarsi all yellow................*mesillæ* Cockerell.
7.—Collar all black, with tubercles with a light spot........................8.
Collar with light marks..11.
8.—Small species, anterior wing not over 3.7 mm. long........................9.
Much larger and more robust species..10.
9.—Mesothorax dull..*cressoni* Cockerell.
Mesothorax shining....................*repolitus* Cockerell and Sumner.

10.—Lateral face-marks curved away from orbit at upper end... *verticalis* Cresson.
Lateral face-marks not curved away from orbit.
ellipticus Kirby (*varifrons* Cresson).
11.—Small species; anterior wing not over 3.7 mm............................12.
Much larger and more robust, first tergite practically impunctate... ....13.
12.—Lateral face-marks long and narrow, going well above level of antennæ; first tergite very conspicuously punctured.
wootoni Cockerell (and *divergens* Cockerell).
Lateral marks broader, and short, not going above level of antennæ; first tergite very weakly and inconspicuously punctured.
rudbeckiæ Cockerell and Casad.
13.—Lateral face-marks minute; scutellum somewhat shining.. *coloradensis* Cockerell.
Lateral face-marks large and conspicuous; scutellum larger, less shining....14.
14.—More robust; mesothorax dull and very densely punctured all over; face much broader.................................... ......*modestus* Say.
Less robust; mesothorax more shining and less punctured; face much narrower.
episcopalis[1] Cockerell.

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[1] (Motz says female *H. episcopalis* is known by the long lateral face-marks, long clypeus, and abdomen punctured as in the male, i.e., first tergite smooth, conspicuously punctured with small punctures, separated by two or three times the diameter of one puncture.)

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NEW OR LITTLE-KNOWN TIPULIDÆ IN THE AMERICAN MUSEUM OF NATURAL HISTORY (DIPTERA).—I

By Charles P. Alexander[1]

The crane-flies discussed in the present report were collected by Mr. G. H. H. Tate on Mount Roraima, Brazil, and on Mount Duida, Venezuela. The material is of especial interest because of the geological structure and isolation of these two mountains. The tipulid fauna of the two localities is distinct, but this may prove to be a matter of insufficient collecting, since certain of the species are wide-spread in the Neotropics. Most of the species described as new will probably be found to be restricted to the mountains in question. I am greatly indebted to Mr. Curran for the opportunity of studying this very interesting series of crane-flies. All types and uniques are preserved in the collection of The American Museum of Natural History.

The conditions encountered by Mr. Tate in his ascent of Roraima have been delightfully described in his article, 'Through Brazil to the Summit of Mount Roraima,' National Geographic Magazine, November, 1930, LVIII, pp. 585–605. The following paragraph is of interest. "With nightfall and the lighting of the gasoline lantern came a host of night moths, daddy longlegs, and flying creatures that, despite our search, we seldom found by day."

Besides the species recorded at this time, the series included a few additional species in condition too poor to be determined.

The collection includes the following Tipulidæ.

Mt. Roraima, Brazil

Tipula arecuna, new species
Brachypremna breviventris (Wiedemann)
Limonia (*Limonia*) *roraimæ*, new species
Limonia (*Neolimnobia*) *diva* (Schiner)
Limonia (*Dicranomyia*) *dolorosa*, new species
Limonia (*Geranomyia*) *tatei*, new species
Limonia (*Geranomyia*) *arecuna*, new species
Limnophila roraima, new species
Limnophila roraimicola, new species

Mt. Duida, Venezuela

Ozodicera duidensis, new species
Tipula duidæ, new species
Limonia (*Rhipidia*) *conica turrifera*, new subspecies
Limonia (*Geranomyia*) *rubiginosa*, new species
Helius (*Helius*) *albitarsis* Osten Sacken
Limnophila kaieturana Alexander
Atarba (*Atarba*) *unilateralis*, new species
Teucholabis (*Teucholabis*) *duidensis*, new species

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[1]Massachusetts State College Amherst.

TIPULINÆ

Ozodicera (Ozodicera) duidensis, new species

Figures 1, 11 and 12

General coloration yellowish gray, the præscutum with four dark brown stripes, the intermediate pair only narrowly separated; flagellar branches short; wings brownish gray; male hypopygium with the apex of the sternite produced into a slender roughened point immediately dorsad of the point of insertion of the diststyles; inner dististyle narrowed to a long chitinized point, with a smaller sublateral spine.

MALE.—Length, about 20–23 mm.; wing, 17.5–20 mm.; antenna, about 4.3–4.4 mm.

FEMALE.—Length, about 22 mm.; wing, 18 mm.

Frontal prolongation of head elongate, dark brown; nasus very small but distinct. Antennæ with the basal segment dark brown, the second obscure yellow; flagellum entirely black; flagellar branches (male) short, the longest (flagellar segment five) about two-thirds the segment; branches of flagellar segments two to seven small, triangular in outline; terminal flagellar segments elongate, slightly exceeding the remainder of flagellum. Head brownish gray, somewhat clearer gray adjoining the eyes; anterior vertex narrow, more buffy; front similarly colored, variegated with brown.

Mesonotal præscutum yellowish gray, with four dark brown stripes, the intermediate pair only narrowly and vaguely divided; pseudosutural foveæ small, blackened, nearly marginal in position; scutum gray, the centers of the lobes darker; scutellum gray, with a vague capillary brown median vitta; postnotal mediotergite gray. Pleura gray, indistinctly variegated with brown on the anepisternum, ventral sternopleurite and dorsal pleurotergite. Halteres elongate, dark brown, the knobs slightly paler, more yellowish brown. Legs with the coxæ pruinose; trochanters reddish brown; femora and tibiæ reddish brown, the tips narrowly dark brown or black; tarsi reddish brown, the outer segments blackened. Wings (Fig. 1) with a brownish-gray tinge, the costal region and stigma more yellowish brown; a vague pale brown seam on the anterior cord; veins brown. Venation: distal half of R_{1+2} pale, subobliterated; cell M_1 broadly sessile.

Abdominal tergites reddish yellow, narrowly blackened laterally, the dorsomedian region dark brown, on the outer segments the areas becoming more extensive and finally confluent; caudal margins of segments restrictedly pale yellow; sternites obscure yellow, the extreme caudal margin yellow. Male hypopygium (Fig. 11) with the sternite and basistyle extended far beyond the level of the tergite, the dististyles at extreme tip. Ninth tergite (Fig. 12) with a V-shaped median notch, the broad lateral lobes feebly emarginate, the median lobule a little more produced caudad than the lateral shoulders. Apex of the fused basistyle and sternopleurite produced into a slender blackened point, its surface set with abundant tubercles. Dististyles about as figured; inner style narrowed to a chitinized point, with a smaller, more obtuse subterminal point.

HABITAT.—Venezuela.

HOLOTYPE, ♂, Mount Duida, November 30, 1928 (G. H. H. Tate); Coll. No. 412. ALLOTOPOTYPE, ♀, with the type. PARATOPOTYPES, two fragmentary specimens, sex unknown, one collected with the types, the other on January 11, 1929; Coll. No. 651.

Ozodicera (*Ozodicera*) *duidensis* is best defined by the combination of grayish coloration, short antennal pectinations, and the structure of the male hypopygium. Its closest ally would appear to be *O.* (*O.*) *bispinifera* Alexander (Brazil).

Tipula arecuna, new species

Figures 13 and 14

General coloration of thorax black, including three polished brownish-black stripes on an obscure yellow ground; scutal lobes blackened; scutellum yellowish testaceous, the parascutella abruptly blackened; thoracic pleura chiefly blackened; antenna short, the basal flagellar segments bicolorous; wings yellow, with a heavy tesselated brown and grayish-brown pattern; male hypopygium with the tergite thin, feebly sclerotized, with a deep U-shaped median notch, the lateral lobes broad, obtusely rounded at tips; no appendages on the eighth and ninth sternites.

MALE.—Length, about 14 mm.; wing, 17.5 mm.

Frontal prolongation of head dark brown; nasus slender; palpi with the basal segment obscure yellow, the second and third dark brown, more whitish at the incisures; outer segment black. Antennæ short; scapal segments honey-yellow; flagellum obscure yellow, the segments ringed just beyond base with brown, this ring including the four verticils which exceed the segments in length; outer flagellar segments more uniformly darkened. Head brown, the front more yellowish brown.

Posterior pronotum obscure yellow medially, passing into dark brown on the sides. Mesonotal præscutum with the ground-color polished obscure yellow, with three polished dark brown or brownish-black stripes, the median stripe reaching the suture, the broad lateral stripes including the entire lateral margins of the sclerite behind the punctiform psuedosutural foveæ; scutal lobes almost entirely blackened, the median region very restrictedly obscure yellow; scutellum yellowish testaceous, the parascutella abruptly black; postnotal mediotergite polished black, vaguely brightened along the lateral margins. Pleura chiefly brownish black, with vague obscure yellow areas on the posterior sternopleurite and ventral pteropleurite; dorsopleural region buffy-yellow. Halteres obscure yellow. Legs with the fore and middle coxæ brownish black, the posterior coxæ paler, more yellowish brown; trochanters yellow; remainder of legs broken. Wings with the ground-color cream-yellow, cell *Sc* bright yellow, cell *C* chiefly infumed; a very heavy brown and grayish brown tesselated pattern that is almost like that found in *bigotiana*, including four solid brown darkenings in cell *Sc*, these being narrower than the interspaces; veins yellow, infuscated in the clouded areas; obliterative areas extensive. Venation: *Rs* long; R_{1+2} entire; petiole of cell M_1 a little longer than its petiole.

Abdominal tergites brownish yellow, margined laterally with brownish black, the bases of the segments somewhat darker than the apical portions; sternites and hypopygium more uniform yellow. Male hypopygium (Fig. 13) with the ninth tergite (Fig. 14) large, depressed, entirely pale and but feebly sclerotized, the caudal margin with a deep U-shaped notch, the sublateral lobes thus formed broadly and obtusely rounded at apex. Tergite and sternite fused into a ring. Basistyle complete. Inner dististyle as shown; outer dististyle of unique type apparently destroyed, not visible. Eighth and ninth sternites without appendages.

HABITAT.—Brazil.

HOLOTYPE, ♂, Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate); Coll. No. 26.

The specific name, *arecuna*, is that of the tribe of Indians living nearest the mountain. In its wing-pattern, *Tipula arecuna* much resembles species like *T. bigotiana* Alexander and *T. mocoa* Alexander, differing in the coloration of the body, especially of the thorax. The structure of the male hypopygium would seem to exclude the present species from the *glaphyroptera* group, where, at first sight, it would appear to belong.

Tipula duidæ, new species

Figure 15

Belongs to the *glaphyroptera* group; mesonotum light golden-yellow, with three dark chocolate-brown stripes; antennæ short, bicolorous; femora blackened, with a conspicuous yellow subterminal ring; wings creamy-yellow, with a heavy brown pattern; male hypopygium with the median appendage of the eighth sternite small, simple.

MALE.—Length, about 14–15 mm.; wing, 16.5–17.5 mm.

Frontal prolongation of head obscure yellow dorsally, passing into black beneath; nasus long and slender; palpi with the basal two segments light brown, the remainder brownish black, the apex of the third pale. Antennæ (male) short, if bent backward, not attaining the wing-root; scape yellow, the base of the first segment darkened; flagellar segments bicolorous, blackened at base, the longer apical portion yellow; outer segments more uniformly darkened. Head brownish yellow, more suffused with brown on anterior vertex and on genæ, with an additional capillary dark brown vitta, the ground-color most evident on either side of the posterior vertex.

Pronotum dark brown medially, paler sublaterally. Mesonotal præscutum light golden-yellow, with three dark chocolate-brown stripes that are nearly confluent behind; scutum brownish gray, the centers of the lobes dark brown; scutellum gray, broadly dark brown medially; postnotal mediotergite yellowish gray, with a blackened ⊥-shaped marking. Pleura brown, the ventral pleurotergite more blackened; dorso-pleural region buffy brown. Halteres long, pale brown, the base of stem narrowly brightened, the knobs, in cases, brownish yellow. Legs with the coxæ and trochanters chiefly brown; femora dark brown to black outwardly, more yellowish at base, with a narrow but conspicuous yellow subterminal ring, the extreme tip of the segment paling from black to brown or yellow; tibiæ light brown, the tips narrowly darkened; tarsi light brown, the outer segments blackened. Wings with the ground-color creamy yellow, the costal margin more saturated; a heavy brown pattern, including four solid darker brown areas in cell *Sc*, a heavy tesselate brown pattern, covering the entire wing-disk, being more extensive than the pale ground-color except in cells *R* and *M;* in outer end of cell *M* a ring-like area, gray, margined with brown; veins dark, paler in the yellowish areas. Venation: R_{1+2} entire, the distal two-thirds pale yellow; petiole of cell M_1 from one-third to two-thirds longer than *m;* fork of M_{3+4} at near one-third the length of cell *1st* M_2.

Abdominal tergites brown, more blackened laterally, before caudal margin on either side with a brighter yellow area; subterminal segments more uniformly dark brown; sternites yellow, the caudal margins of the segments narrowly dark brown. Male hypopygium (Fig. 15) small, the ninth tergite extensive, narrowed outwardly, terminating in two small spinous points that are separated by a small U-shaped median notch; when viewed from the side, these points appear as small flattened blades; lateral margins of tergite fringed with setæ. Outer dististyle a slender, weakly clavate lobe. Appendage of eighth sternite a small, simple, finger-like lobe that is about three times as long as wide at base.

HABITAT.—Venezuela.

HOLOTYPE, ♂, Mount Duida, January 11, 1929 (G. H. H. Tate); Coll. No. 552. PARATOPOTYPE, ♂.

Tipula duidæ is best distinguished from the other members of the *glaphyroptera* group with tesselated wings by the combination of characters summarized above.

Brachypremna breviventris (Wiedemann)

Tipula breviventris WIEDEMANN, 1821, 'Dipt. Exot.,' I, p. 43.

Tipula breviventris WIEDEMANN, 1828, 'Aussereur. zweifl. Ins.,' I, p. 47.

Brachypremna breviventris OSTEN SACKEN, 1886, Berliner Ent. Zeitschr., XXX, p. 161.

Brachypremna breviventris ALEXANDER, 1912, Journ. N. Y. Ent. Soc., XX, pp. 230–231.

Slopes of Mount Roraima, Brazil, altitude 4000 feet, November 5, 1927 (Paulo). This fly has a wide distribution in northern South America.

LIMONIINÆ

Limonia (Limonia) roraimæ, new species

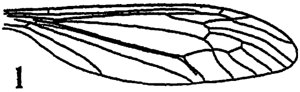
Figure 2

General coloration polished yellow; rostrum, palpi, and antennæ black; head blackish gray; halteres yellow; femora yellowish brown, darkest at base, with a conspicuous, obscure yellow, nearly terminal ring; wings yellow, more saturated in the costal and apical portions, with conspicuous dark brown seams and paler brown washes; basal section of R_{4+5} very short

Sex(?).—Wing, 9–10.4 mm.

Rostrum and palpi black. Antennæ black throughout; basal flagellar segments subtriangular to cordiform, with very short, thick, apical pedicels; verticils unilaterally arranged, not exceeding the segments. Head blackish gray; anterior vertex reduced to a linear strip.

Pronotum dark brown medially, paling to yellow on sides. Mesonotal præscutum chiefly polished yellow, the interspaces in front a little darker; scutellum medially and the cephalic portion of the postnotal mediotergite more darkened. Pleura yellow. Halteres yellow. Legs with the coxæ and trochanters yellow; femora yellowish brown, darkest at extreme base, with a conspicuous obscure yellow, nearly terminal ring; tibiæ brownish yellow, the tips narrowly darkened; outer tarsal segments blackened; claws with about three teeth, the outermost longest. Wings (Fig. 2) with a bright yellow ground-color, the prearcular, costal, and outer radial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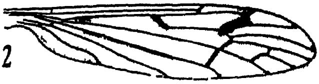
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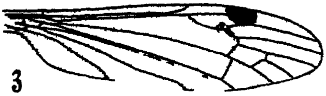
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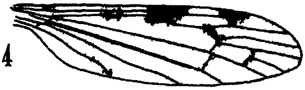
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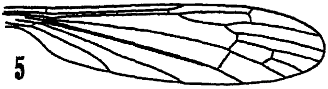
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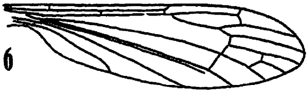
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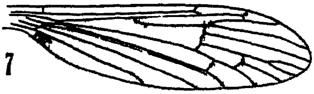
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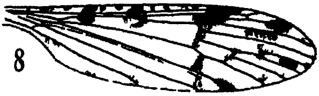
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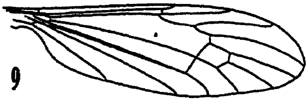
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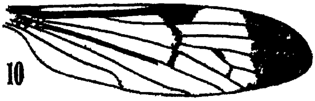
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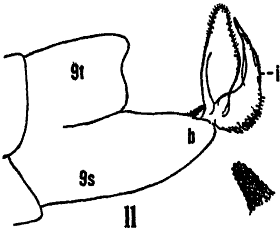
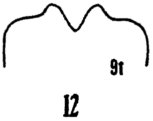
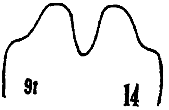
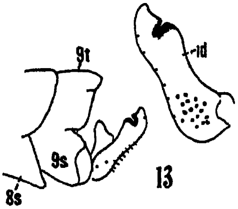
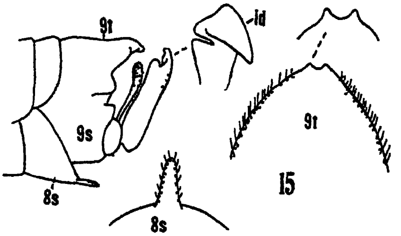
Fig. 1. *Ozodicera (Ozodicera) duidensis*, new species; wing.
" 2. *Limonia (Limonia) roraimæ*, new species; wing.
" 3. *Limonia (Dicranomyia) dolerosa*, new species.; wing.
" 4. *Limonia (Geranomyia) tatei*, new species; wing.
" 5. *Limonia (Geranomyia) arecuna*, new species; wing.
" 6. *Limonia (Geranomyia) rubiginosa*, new species; wing.
" 7. *Limnophila roraima*, new species; wing.
" 8. *Limnophila roraimicola*, new species; wing.
" 9. *Atarba (Atarba) unilateralis*, new species; wing.
" 10. *Teucholabis (Teucholabis) duidensis*, new species; wing.

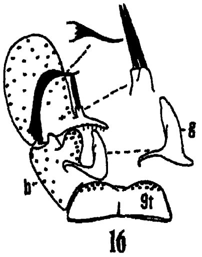


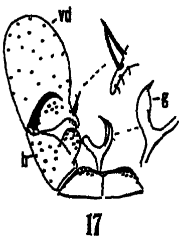












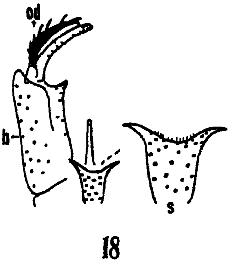


Fig. 11. *Ozodicera (Ozodicera) duidensis*, new species; male hypopygium, lateral aspect.

" 12. *Ozodicera (Ozodicera) duidensis*, new species; male hypopygium, ninth tergite, dorsal aspect.

" 13. *Tipula arecuna*, new species; male hypopygium, lateral aspect.

" 14. *Tipula arecuna*, new species; male hypopygium, ninth tergite, dorsal aspect.

" 15. *Tipula duidæ*, new species; male hypopygium, details.

" 16. *Limonia (Geranomyia) tatei*, new species; male hypopygium.

" 17. *Limonia (Geranomyia) arecuna*, new species; male hypopygium.

" 18. *Atarba (Atarba) unilateralis*, new species; male hypopygium.

[Symbols: b = basistyle; g = gonapophysis; id = inner dististyle; od = outer dististyle; s = sternite; t = tergite; vd = ventral dististyle.]

regions more saturated yellow; a restricted dark brown pattern, including narrow seams at origin of *Rs*; fork of *Sc*; R_2 and R_{1+2}, along cord and outer end of cell *1st* M_2; and as narrow marginal clouds at ends of all longitudinal veins; paler brown washes in base of cell *R*; at stigma, the latter sending a conspicuous darker brown extension basad over the anterior cord; posterior cells of wing, from M_3 to *2nd A* with marginal brown washes, leaving the region of the vein clear yellow; veins yellow, darker in the clouded areas. Venation: Sc_1 ending about opposite two-thirds to three-fourths the length of *Rs*, Sc_2 near its tip; *Rs* angulated at origin; basal section of R_{4+5} very short, arcuated; cell *1st* M_2 relatively large, subequal in length to vein M_{1+2} beyond it; basal section of M_3 long, arcuated; *m-cu* at or before the fork of *M*, about one-half longer than the distal section of Cu_1.

Abdominal tergites obscure yellow, the organ broken beyond segment two.

HABITAT.—Brazil.

HOLOTYPE, sex(?), Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate). PARATOPOTYPE, Sex'

Limonia (Limonia) roraimæ is most closely allied to *L. (L.) sanctæ martæ* Alexander (Colombia) in the general features of wing-pattern, differing in the details of venation and coloration, such as the darkened tips of the femora in the latter species.

Limonia (Neolimnobia) diva (Schiner)

Limnobia diva SCHINER, 1868, 'Novara Reise,' Diptera, p. 46.

Dicranomyia (Neolimnobia) diva ALEXANDER, 1928, Dept. Sci. and Agr. Jamaica, Ent. Bull., IV, p. 20.

Three specimens, Mount Roraima, Brazil, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate). The species has a wide range in the northern Neotropical region.

Limonia (Rhipidia) conica turrifera, subspecies

Differs from typical *conica* Alexander (Trans. American Ent. Soc., 1914, XL, pp. 227–228) of British Guiana, only in the more restricted dark wing-pattern. The dark areas of the membrane are small, clearly delimited, and, for the most part, entirely surrounded by the pale yellow ground-color. In the typical form, the darkened subcostal areas are triangular in outline, widest at caudal ends and merging into the dark ground-color of the medial and posterior regions of the wing.

HABITAT.—Venezuela.

HOLOTYPE, ♀, Mount Duida, November 18, 1928 (G. H. H. Tate); Coll. No. 338. PARATOPOTYPE, a broken ♀, November 4, 1928; Coll. No. 149.

Limonia (Dicranomyia) dolerosa, new species

Figure 3

General coloration black, including the disk of the mesonotal præscutum; antennæ black throughout; thoracic pleura brownish black, traversed by a narrow transverse pale line on the pteropleurite; legs chiefly black, the extreme femoral tips vaguely paler, especially on their flexor surface; wings with a strong blackish tinge, the stigma and a diffuse seam along cord somewhat darker; free tip of Sc_2 about its own length before R_2.

FEMALE.—Length, about 10–11 mm.; wing, 10.3–10.5 mm.

Rostrum relatively elongate, exceeding one-half the remainder of head, black; palpi black. Antennæ black throughout; flagellar segments long-oval, the verticils shorter than the segments; terminal segment longer than the penultimate. Head black, very sparsely pruinose; anterior vertex a little wider than the diameter of the scape.

Pronotum black, paler laterally. Mesonotal præscutum chiefly covered by three nearly confluent black stripes, the humeral and lateral portions obscurely brightened; scutal lobes blackened, the median area pale; scutellum brownish testaceous; postnotal mediotergite black, restrictedly paler on the anterolateral portions. Pleura chiefly brownish black, interrupted by a narrow pale transverse line extending from the wing-root, crossing the pteropleurite to the meral region. Halteres dark brown, the base of the stem restrictedly pale yellow. Legs with the fore coxæ black, the remaining coxæ and all trochanters obscure yellow; femora dark brown, obscurely brightened at extreme base and tip, the latter more especially so on the flexor surface; remainder of legs black. Wings (Fig. 3) with a strong blackish tinge, the oval stigma darker; an ill-defined darkened cloud on the cord; paler longitudinal streaks in certain cells, more especially *R*, *M*, and M_4, crossing the cord and outer end of cell *1st* M_2 and forming bullate areas; veins dark brown. Venation: Sc_1 ending opposite the origin of *Rs*, Sc_2 some distance from its tip, Sc_1 alone being more than one-half *Rs;* free tip of Sc_2 some distance before the level of R_2; *m-cu* beyond the fork of *M* about one-third longer than the distal section of Cu_1; cell *2nd A* wide.

Abdominal tergites black, the basal sternites obscure yellow, the outer segments more blackened, especially laterally. Ovipositor with the tergal valves slender, relatively short and straight, narrowly blackened at bases; sternal valves blackened at bases, their tips reddish horn-color.

HABITAT.—Brazil.

HOLOTYPE, ♀, Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate). PARATOPOTYPE, ♀.

In its strongly infumed wings, *Limonia (Dicranomyia) dolerosa* is most similar to *L.* (*D.*) *dampfi* (Alexander), of Mexico, and *L.* (*D.*) *selkirki* (Alexander), of the Islands of Juan Fernandez, differing in the details of coloration and venation, especially the wide second anal cell.

Limonia (Geranomyia) tatei, new species

Figures 4 and 16

General coloration reddish gray, the præscutum with five narrow liver-brown stripes, the outermost pair on the lateral margins; knobs of halteres darkened; femora with two dark brown and two yellow annuli; wings cream-yellow, with a very heavy brown pattern, including the broad apex; Sc_1 ending at near one-third the length of *Rs;* male hypopygium with the rostral spines of the ventral dististyle arising from a common tubercle.

MALE.—Length, excluding rostrum, about 5.5 mm.; wing, 7.4 mm.; rostrum, about 3.5 mm.

FEMALE.—Length, excluding rostrum, about 6 mm.; wing, 7.2 mm.; rostrum, about 3.4 mm.

Rostrum relatively elongate, exceeding one-half the length of body, black, the distal third of labial palpi paling to brown; maxillary palpi black. Antennæ short, black; flagellar segments subcylindrical, without pedicels. Head dark gray, the posterior vertex with a blackish area on either side of the median line.

Mesonotal præscutum with the ground-color reddish, sparsely pruinose, especially laterally behind, with five dark liver-brown stripes, the three intermediate ones narrow, but still wider than the interspaces, the outermost stripes occupying the lateral margins of the sclerite; median area of scutum yellowish, the lobes gray, margined with liver-brown, most intense and best defined on the mesal margin of lobe; scutellum pale brownish testaceous; postnotal mediotergite blackish. Pleura blackened dorsally, the sternopleurite and meron paler, more brownish. Halteres with base of stem yellow, the remainder, including knobs, dark brown. Legs with the coxæ brownish testaceous; trochanters obscure yellow; femora obscure yellow at bases, on distal half becoming dark brown, this area enclosing two yellow rings, one apical, the other subterminal in position, the total effect being of two dark brown and two yellow rings; tibiæ yellowish brown, the tips dark brown; tarsi light brown, the terminal segments blackened. Wings (Fig. 4) cream-yellow, more saturated along the costal margin, with a very heavy brown pattern, distributed as a series of four costal areas, broad seams to the cord, outer end of cell *1st* M_2, and the longitudinal veins of the medial and cubital fields; area at stigma confluent posteriorly with the seaming along cord; wing-tip broadly and almost evenly darkened; cells *M* and *Cu* extensively suffused with brown; extensive darkened clouds at ends of anal veins, sending paler washes basad into their respective cells; veins yellow in the ground-area, darker in the clouded portions. Venation: Sc_1 ending about opposite one-third the length of *Rs*, Sc_2 at its tip; *h* and a supernumerary crossvein in cell *Sc* present but only faintly preserved; vein R_{4+5} bending strongly caudad at *r–m*, narrowing the latter; cell *1st* M_2 about as long as the longest vein beyond it; *m–cu* close to fork of *M*.

Abdomen brownish black, the caudal margins of the segments narrowly and very indistinctly paler; hypopygium dark. Male hypopygium (Fig. 16) with the tergite transverse, each lateral lobe low, provided with about fifteen strong setæ. Ventral dististyle large and fleshy, the rostral prolongation small, slender, at base with a common tubercle that bears two straight, subequal spines of moderate length. Dorsal dististyle a chitinized sickle, widest just before the unusually long pointed apex. Gonapophyses with the mesal apical lobe pale, blunt at apex, the lateral arms of the apophysis very narrow.

HABITAT.—Brazil.

HOLOTYPE, ♂, Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate). ALLOTOPOTYPE, ♀.

Limonia (*Geranomyia*) *tatei* is named in honor of the collector of this unusually interesting series of Tipulidæ, Mr. G. H. H. Tate. This fly is very distinct in the heavy wing-pattern, which is approached in the Neotropical fauna only by *L.* (*G.*) *townsendi* (Alexander) of Peru, an otherwise very different fly.

Limonia (Geranomyia) arecuna, new species

Figures 5 and 17

General coloration reddish brown, the præscutum unmarked; legs brown; wings subhyaline, unmarked except for the stigma; *Sc* short, Sc_1 ending opposite the origin of *Rs;* a supernumerary crossvein in cell *Sc,* male hypopygium with the ventral dististyle large and fleshy, the rostral spines straight, separated at base, the innermost from a slightly developed tubercle; gonapophyses acutely pointed at tips.

MALE.—Length, excluding rostrum, about 4.6 mm.; wing, 5.5 mm.; rostrum, about 2.3 mm.

FEMALE.—Length, excluding rostrum, about 6 mm.; wing, 5.8–6.5 mm.; rostrum, about 2.4 mm.

Rostrum relatively elongate, black; maxillary palpi black. Antennæ black throughout. Head light gray, variegated with blackish areas on vertex.

Mesonotum reddish brown, without markings; scutellum more yellowish testaceous. Pleura yellowish testaceous. Halteres pale, the knobs infuscated. Legs with the coxæ and trochanters yellow; femora yellowish at bases, passing into brown; tibiæ darker brown, the tarsi slightly paler, especially the posterior tarsi; fore tibiæ not blackened at tips, as is the case in the *tibialis* group. Wings (Fig. 5) subhyaline, unmarked except for the small oval brown stigma; veins darker brown. Venation: Sc_1 ending opposite or just beyond the origin of *Rs*, Sc_2 a short distance from its tip; a supernumerary crossvein in cell *Sc* beyond midlength; *m-cu* close to fork of *M*.

Abdomen dark reddish brown, the extreme caudal margins of the segments paler; sternites brownish yellow. Male hypopygium (Fig. 17) with the tergite transverse, the very low lobes provided with numerous setæ. Ventral dististyle large and fleshy, its rostral prolongation small and slender, the two spines straight, obliquely acute at tips, separated at base, the innermost arising from a small basal tubercle. Dorsal dististyle a small curved sickle. Gonapophyses with the mesal-apical lobe an acutely pointed blade.

HABITAT.—Brazil.

HOLOTYPE, ♂, Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate). ALLOTOPOTYPE, ♀. PARATOPOTYPE, ♀.

Limonia (*Geranomyia*) *arecuna* is named after the Arecuna Indians, living near Mount Roraima. In its general appearance, the present fly most closely resembles the Cuban *L.* (*G.*) *myersiana* Alexander, differing in the lack of blackened tips to the fore tibiæ, and in the structure of the male hypopygium.

Limonia (Geranomyia) rubiginosa, new species

Figure 6

General coloration of thorax reddish, the præscutum darker medially but otherwise unmarked; antennæ black throughout; halteres dusky; legs chiefly dark brown, the femora not variegated with annuli at or near tips; wings with a brownish tinge, the brown pattern very restricted in area; *Sc* short; *m-cu* close to fork of *M*.

FEMALE.—Length, excluding rostrum, about 5–5.5 mm.; wing, 6.2–6.8 mm.; rostrum, 2.6 mm.

Rostrum about one-half the length of body, black, the labial palpi paling at extreme tips. Antennæ black; flagellar segments subcylindrical, closely applied to one another; verticils relatively small and inconspicuous; terminal segment about one-half longer than the penultimate, pointed at apex. Head light gray, the posterior vertex a trifle darkened on either side of median line.

Mesonotal præscutum reddish, more darkened medially; posterior sclerites of mesonotum dark reddish brown to dark brown, pruinose. Pleura reddish yellow. Halteres dusky. Legs with the coxæ reddish yellow; trochanters yellow; femora yellow basally, the fore femora almost uniformly yellow, the posterior femora passing into dark brown shortly beyond base; remainder of legs brown. Wings (Fig. 6) with a brownish tinge; stigma subcircular, dark brown; very restricted to scarcely evident dark clouds at Sc_2, origin of Rs, along cord and on outer end of cell *1st* M_2; veins light brown, darker in the clouded areas. Venation: Sc_1 ending opposite or just before origin of Rs, Sc_2 at its tip; a supernumerary crossvein close to midlength of cell Sc; Rs weakly angulated at origin; cell *1st* M_2 long, gently widened outwardly, the second section of M_{1+2} subequal to or a little longer than the outer section; *m-cu* at or close to fork of M; vein *2nd A* sinuous, the cell wide.

Abdomen dark brown, the caudal margins of the sternites very narrowly pale; genital segment reddish yellow, the valves yellow, the tergal valves very gently upcurved, their tips subobtuse; sternal valves short and stout, their tips pointed.

HABITAT.—Venezuela. HOLOTYPE, ♀, Mount Duida, December 10, 1928 (G. H. H. Tate); Coll. No. 446. PARATOPOTYPE, ♀, November 29, 1929; Coll. No. 410.

Limonia (*Geranomyia*) *rubiginosa* is distinct from all described regional species in the unvariegated wings, with Sc short, the uniformly reddish thorax, the dusky halteres, and the unringed femora.

Helius (Helius) albitarsis (Osten Sacken)

Rhamphidia albitarsis OSTEN SACKEN, 1887, Berliner Entomolog. Zeitschr., XXXI, p. 184.

One broken specimen from Mount Duida, Venezuela, November 28, 1928 (G. H. H. Tate); Coll. No. 394. The species was described from Porto Rico but is now known to have a wide range in the northern Neotropical region. It is more than possible that several closely allied species have been confused under this specific name.

Limnophila kaieturana Alexander

Limnophila kaieturana ALEXANDER, 1930, Ann. Ent. Soc. America, XXIII, p. 733.

One broken female, Mount Duida, Venezuela, November 28, 1928 (G. H. H. Tate); Coll. No. 394. Known previously only from the type-locality, Kaietur Falls, British Guiana.

Limnophila roraima, new species

Figure 7

General coloration pale ochreous, the pronotum and mesonotal præscutum with a capillary dark brown median vitta; antennæ short in both sexes, the scape and extreme base of flagellum pale; legs yellow; wings cream-yellow, with a pale brown pattern that is mostly confined to the vicinity of the veins; *m–cu* at near midlength of cell *1st* M_2.

MALE.—Length, about 8–8.5 mm.; wing, 8–8.6 mm.

FEMALE.—Length, about 8 mm.; wing, 8–8.5 mm.

Rostrum and palpi dark brown. Antennæ short in both sexes; scape and basal one or two of flagellar segments pale; remaining flagellar segments dark brown, the basal and intermediate segments weakly bicolorous, the extreme base of each segment being pale; flagellar segments oval. Head yellowish gray.

Pronotum and mesonotal præscutum buffy or ochreous, with a capillary median dark brown line, the remainder of the usual three præscutal stripes scarcely darker than the ground-color; remainder of mesonotum ochreous; scutal lobes slightly darkened; posterior portion of postnotal mediotergite with two confluent more brownish areas. Pleura chiefly yellowish ochreous, in more heavily patterned specimens with brown areas on anepisternum and pteropleurite, to form a vague dorsal darkening. Halteres pale yellow. Legs with the coxæ and trochanters yellow; remainder of legs yellow, the terminal tarsal segments slightly darker. Wings (Fig. 7) cream-yellow, with a pale brown pattern, arranged as follows: extreme bases of cells *R* and *M*, origin of *Rs*, fork of *Sc*, along cord and outer end of cell *1st* M_2, R_2, tip of R_3, fork of M_{1+2}, *m–cu*, at about two-thirds the length of cell *M*, axilla, and as marginal circular clouds at ends of veins M_2 to *2nd A*, inclusive; in more heavily patterned individuals with additional clouds at near midlength of cells R_4 and R_5; veins yellow, darker in the clouded areas. Venation: Sc_1 ending just before the fork of *Rs*, Sc_2, longer, near its tip; inner ends of cells R_4, R_5, and *1st* M_2 in slightly oblique alignment; *m–cu* at or beyond midlength of cell *1st* M_2; anterior arculus preserved.

Abdomen yellowish to dark brown, the sternites clearer yellow; hypopygium yellow.

HABITAT.—Brazil.

HOLOTYPE, ♂, Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate); Coll. No. 40. ALLOTOPOTYPE, ♀. PARATOPOTYPES, 10 ♂, ♀, some in poor condition. PARATYPES, 2 fragments, altitude 6800 feet, November, 1927 (Gen. C. M. da S. Rondon).

Limnophila roraima was by far the most abundant crane-fly found on the summit of Roraima. It is allied to *L. kaieturana* Alexander and *L. roraimicola*, new species, but is well distinguished by the pale ochreous coloration and the wing-pattern, which produces the effect of a very pale brown spotting on a cream-yellow ground.

Limnophila roraimicola, new species

Figure 8

General coloration gray, the præscutum with three brown stripes; wings whitish subhyaline, with a heavy brown pattern, including a series of nearly twenty more or less confluent brown spots in the costal cell; remainder of wing-disk with a heavy brown pattern, some of the areas with pale centers to produce an ocellate appearance; anterior arculus preserved; abdomen black.

FEMALE.—Length, about 8.5 mm.; wing, 9 mm.

Rostrum gray; palpi black. Antennæ with the scapal segments dark brown, the first sparsely dusted with gray; flagellar segments broken. Head dark gray, somewhat clearer in front and on the orbits; two median, dark, more or less impressed spots on vertex.

Mesonotum gray, the præscutum with a brown median stripe, and shorter, less distinct, lateral stripes; interspaces with brown setigerous punctures; no tuberculate pits; pseudosutural foveæ small, black, comma-shaped; posterior sclerites of mesonotum brown, gray pruinose. Pleura pale brown, pruinose, the anepisternum darker. Halteres pale, the knobs weakly darkened. Legs with the coxæ and trochanters light brown, the former sparsely pruinose; remainder of legs broken. Wings (Fig. 8) whitish subhyaline, with a heavy dark brown pattern, including a series of nearly twenty spots in cell *C*, these more or less confluent; areas at origin of *Rs*, at two-thirds the length of cell *M*, at end of vein *2nd A*; two additional areas in cell *2nd A* are brown with paler centers to produce a more or less ocellate effect; solid brown areas appear as a seam from costa in the stigmal area, across the cord, narrowly interrupted on M_{3+4}; outer end of cell *1st* M_2 darkened; several oval brown clouds in the cells beyond the cord, these chiefly grouped at and near the wing-tip; veins pale, somewhat darker in the infuscated areas. Venation: Sc_1 ending opposite midlength of R_{2+3+4}, Sc_2 at its tip; *Rs* long, nearly straight; R_2 less than one-half R_{1+2}; cell R_3 deep; inner ends of cells R_4, R_5, and *1st* M_2 in subtransverse to weakly oblique alignment; *m-cu* at near one-third the length of cell *1st* M_2; anterior arculus preserved.

Abdomen black. Ovipositor with the valves elongate, the cerci dark basally, paler at tips.

HABITAT.—Brazil.

HOLOTYPE, ♀, Mount Roraima, summit, altitude 8600 feet, November, 1927 (G. H. H. Tate).

Limnophila roraimicola is allied to *L. kaieturana* Alexander and *L. roraima*, new species, but is very distinct from both species in the heavy dark spotted pattern in the costal cell of the wings.

Atarba (Atarba) unilateralis, new species

Figures 9 and 18

General coloration yellow; antennæ (male) elongate, exceeding one-half the body; flagellar segments bicolorous, the base of each segment blackened, the apex yellow; each flagellar segment with a very long, unilaterally arranged bristle; legs yellow; wings yellow, the small diffuse stigma a trifle darker; *Sc* relatively long, Sc_1 extending to beyond one-third the length of the long *Rs;* abdominal tergites weakly dimidiate, the bases yellow, the apices more broadly pale brown.

MALE.—Length, about 6 mm.; wing, 6.3 mm.; antenna, about 4.5 mm.

Rostrum yellow; palpi dark brown. Antennæ (male) elongate, as shown by the measurements; scape and first flagellar segment yellow; succeeding flagellar segments yellow, the base blackened, on the proximal segments this including about the basal third, on the outer segments becoming more extensive but somewhat paler; flagellar segments elongate-cylindrical, with an abundant erect elongate pubescence and one very long bristle that considerably exceeds the pubescence on each segment, these bristles unilaterally arranged; on basal segments the bristle is placed beyond midlength of the segment, on the outer segments becoming more basal in position; terminal segment a little shorter than the penultimate. Head light gray, more yellowish in front.

Mesonotum yellow, becoming more testaceous-yellow on the posterior sclerites. Pleura yellow, the dorsal sclerites more darkened. Halteres dusky, paler at base of stem. Legs with coxæ and trochanters yellow; remainder of legs yellow, the terminal tarsal segments infuscated. Wings (Fig. 9) broad, yellow, the small diffuse stigma a little darker; veins yellowish brown. Venation: *Sc* relatively long, Sc_1 ending beyond one-third the length of *Rs*, the latter elongate, about one-half longer than the basal section of R_3; cell *1st* M_2 long-pentagonal; *m–cu* at the fork of *M*.

Abdominal tergites weakly bicolorous, the bases of the segments light yellow, the apices more broadly pale brown; subterminal segments blackened; sternites and hypopygium more uniformly yellow. Male hypopygium (Fig. 18) with the sternal plate longer than broad, the lateral arms narrowly acute, glabrous. Outer dististyle slender, the apex bifid, the outer margin with three major spines and three progressively smaller appressed denticles. Ædeagus relatively small and slender, in slide mounts not extending to beyond midlength of the basistyle.

HABITAT.—Venezuela.

HOLOTYPE, ♂, Mount Duida, December 28, 1928 (G. H. H. Tate); Coll. No. 394.

Atarba (*Atarba*) *unilateralis* is most nearly allied to *A.* (*A.*) *cincticornis* Alexander (British Guiana) in the pattern of the elongate antennal flagellum, which has the bases of the segments blackened, the apices broadly pale. It differs most evidently in the wing-venation, in the long *Sc* and *Rs*, and in the structure of the antennæ.

Teucholabis (Teucholabis) duidensis, new species

Figure 10

General coloration of mesonotum reddish, the præscutum with three black areas, each scutal lobe with two such areas; posterior legs entirely black, fore legs with femoral bases yellow; wings whitish, the apex and a narrow seam at cord dark brown; *m* long and arcuated, nearly twice the basal section of M_3.

Sex(?).—Wing, 8 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, the basal six more enlarged, short-oval, the remaining segments smaller and more crowded; terminal segment very small. Head black.

Pronotum reddish yellow. Mesonotal præscutum reddish, with three polished black areas, one median on cephalic fifth of the sclerite, the others on lateral margins behind the pseudosutural foveæ; scutum reddish, each lobe with a large oval black center and smaller lateral areas just beind the suture; scutellum reddish orange; postnotal mediotergite similar, margined laterally with black. Pleura orange, with a large central area occupying most of the mesopleura, including the dorsal sternopleurite and most of the anepisternum; meron black; pleurotergite orange, darkened ventrally. Halteres black. Legs with the fore and middle coxæ reddish yellow; posterior coxæ and trochanters black; fore legs black, the basal third of femora yellow; posterior legs entirely black (middle legs broken). Wings (Fig. 10) whitish, the apex and a narrow but conspicuous seam at cord dark brown; prearcular region and cell *Sc* darkened; outer end of cell *1st* M_2 narrowly seamed with brown; stigmal darkening larger than in *decora;* veins brownish black. Venation: *Sc* long, Sc_1 ending beyond five-sixths the length of *Rs;* vein R_3 only gently curved; *m* unusually long, nearly twice the basal section of M_3; *m-cu* close to the fork of *M*.

Abdomen broken.

HABITAT.—Venezuela.

HOLOTYPE, sex(?), Mount Duida, December 30, 1928 (G. H. H. Tate); Coll. No. 497.

Closely allied to *Teucholabis* (*Teucholabis*) *decora* Alexander (Brazil: Para), differing especially in the details of venation, as the very long, arcuated *m*.

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TWELVE NEW DIPTERA

By C. H. Curran

Most of the new species described in this paper have been received for determination during the past year, the descriptions being published at this time in order that the names may be available to those submitting the specimens. Unless otherwise stated the types are in The American Museum of Natural History.

Dolichopidæ

Syntormon Loew

This genus has been revised by Mr. M. C. Van Duzee[1] and the synonymy of *Synarthrus* Loew accepted. Mr. Van Duzee would maintain *Parasyntormon* Wheeler as a separate genus on the basis of the shape of the face of the females, but it seems to me that the character is not sufficiently distinctive to be of generic value. In some cases the males can be assigned to their proper groups, but more often this cannot be done. The logical thing to do, even though it may not be the scientific thing, is to unite the two groups into a single, easily recognized genus and thus eliminate a great deal of uncertainty.

The species which I describe below is probably a *Syntormon* in the strict sense, and for that reason I compare it with species included in the genus by Van Duzee. In his table of species it traces to *simplicitarse* Van Duzee but the wholly black antennæ and palpi, brown proboscis and tarsi, etc., will at once distinguish it. The two species are, actually, very dissimilar. The antennæ are of much the same shape, although the thumb-like projection of the second segment is much shorter in *vanduzeei* than in *simplicitarse*. Incidentally, it appears that the figure of the antenna of *simplicitarse* is inverted, although the shape of the first segment would seem to indicate otherwise.

Syntormon vanduzeei, new species

Green, legs reddish yellow, the tarsi mostly brown. Length, 3 mm.

Male.—Face narrow, evidently brown or blackish; front shining violaceous, the borders narrowly green; orbital cilia whitish, the upper ones black. Palpi blackish.

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[1] 1925, Trans. Amer. Ent. Soc., I, pp. 275–287.

Antennæ black, the second segment rounded apically, the third shaped as in *simplicitarse* Van Duzee; arista as long as the third segment; first segment bare above.

Mesonotum with thin brownish pollen, the sides and pleura whitish pollinose; hair of the propleura white; scutellum with one pair of strong bristles, otherwise bare.

Legs reddish yellow; posterior four coxæ green, whitish pollinose; tarsi, with the exception of the basal two-thirds of the basal segment, brown. Anterior and posterior femora with normal hair. Middle femora on the basal third of the ventral surface with a row of six increasingly strong black bristles and near the middle with three very much weaker ones; the longest bristle is about equal in length to the height of the femur. Anterior tibiæ with a single weak bristle situated on the dorsal surface; middle tibiæ with two anteroventral, three anterodorsal and two posterodorsal bristles; posterior tibiæ with three or four anterodorsal and posterodorsal bristles and with conspicuous short, bristly hair. Anterior four tarsi simple, the basal segment of the posterior pair very slightly curved and bearing short bristly hair, near the apex with two or three erect bristles which are conspicuous.

Wings cinereous hyaline, the veins brown. Squamæ yellow, with brown border and brownish yellow cilia. Halteres yellow.

Abdomen with the sides and venter thinly pale pollinose and bearing pale pile; dorsum black-haired; incisures narrowly blackish. Genitalia hidden, the exposed part brown.

TYPE.—Male, Arnprior, Ontario, August 19, 1930 (Curran).

The specimen was taken resting on low vegetation along the banks of a long, very narrow inlet, the banks of which were narrowly bordered with clay.

Rhaphium furcifer, new species

Figure 3

The genital lamellæ are furcate, the two branches of almost equal proportions; posterior femora black with the basal fifth reddish except on the ventral surface; posterior tibiæ reddish yellow with the basal fourth blackish; face white. The structure of the antennæ is similar to those of *nigrociliatum* Curran and the genital lamellæ are rather similar but are longer before the furcation. In the table of species, *furcifer* traces to *orientale* Curran, but the furcate genital lamellæ distinguish it; since the posterior femora are broadly pale basally it might trace to *grande* Curran, but that species also has unforked lamellæ. Length, 5 mm.

MALE.—Face narrow, white; front green, rather thickly cinereous-white pollinose, the ground color showing through; occiput with cinereous-white pollen and white pile, the occipital cilia black. Palpi small, black, their apices yellowish and with a few fine yellowish hairs. Antennæ black; third segment about as long as the front, triangular; arista slightly longer than antenna.

Thorax green; mesonotum with quite evident brownish pollen, shining posteriorly and laterally; notopleura and pleura cinereous-white pollinose. Six pairs of dorsocentral bristles, the acrosticals becoming long posteriorly; scutellum with a pair of strong lateral bristles and four strong hairs. Propleural pile white.

Legs reddish yellow, the middle pair and anterior tibiæ pale yellowish. Coxæ black, whitish pollinose and pilose, the middle and posterior pair each with a strong pencil of black hair, the middle ones also with a row of black bristles on the apex. Anterior femora mostly brown above, black-haired; behind with long whitish hair, the hair below short and whitish on the basal half and with a double row of rather short, whitish cilia on the basal half of the posteroventral surface, the cilia not as long as the height of the femora. Posterior femora black, the basal fifth reddish yellow except below, the hair wholly black; middle femora with weak bristle before the apex in front and behind. Tibiæ each with two anterodorsal and two posterodorsal bristles, the middle pair with two ventral bristles near the apical fourth.

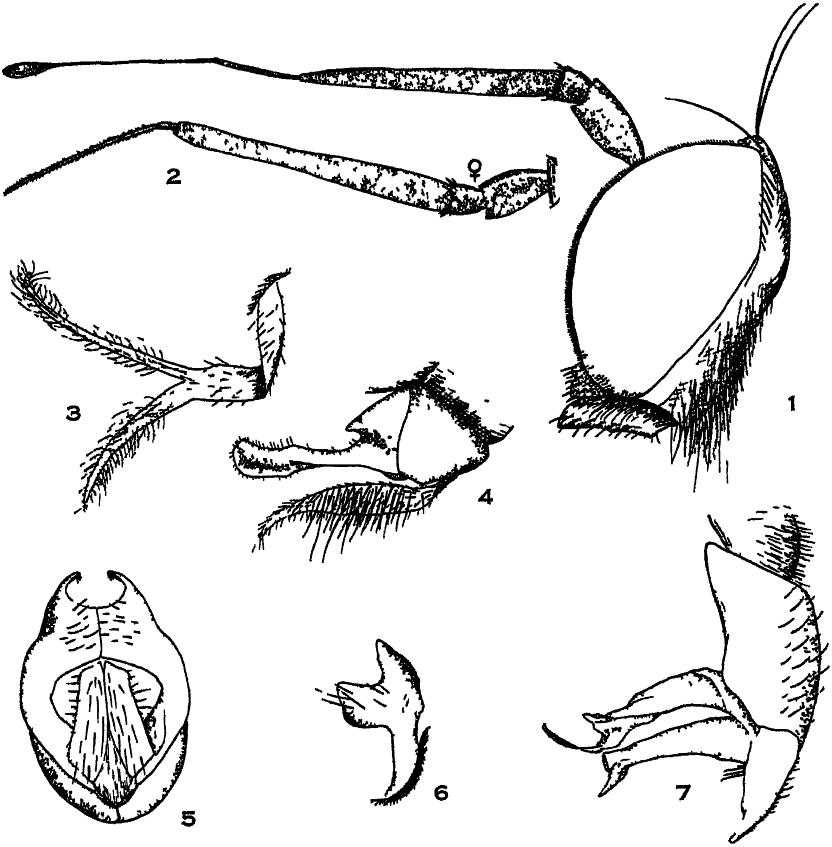

Fig. 1. *Rhaphium browni*, new species. Head of male.
" 2. *Rhaphium browni*, new species. Antenna of female.
" 3. *Rhaphium furcifer*, new species. Genital lamella of male.
" 4. *Rhaphium septentrionale*, new species. Lateral view of male genitalia.
" 5. *Cordilura browni*, new species. Ventral view of male genitalia.
" 6. *Cordilura masconina*, new species. Outer forceps of male genitalia.
" 7. *Ephydra salina*, new species. Lateral view of male genitalia.

Front tarsi yellowish, the two apical segments black, the first segment as long as the remaining segments combined, enlarged at the apex; middle tarsi reddish yellow with the two apical segments black, the first segment with a row of short, black bristles on the basal half of the under surface; basal two segments of the posterior tarsi brownish yellow, their apices, and the apical three segments wholly black. Posterior tibiæ with the apical fifth or more blackish or brown.

Wings with cinereous tinge, rather broad, conspicuously convex between the tips of the anal and sixth veins. Squamæ yellow, their cilia white. Halteres yellow.

Abdomen shining green, the dorsum more or less bronzed, the sides and venter cinereous pollinose. First segment, sides of the abdomen and the venter whitish-yellow pollinose. Genitalia black, cinereous pollinose, the lamellæ yellowish brown, with brownish-yellow hair, furcate on the apical half, the arms of almost equal size.

TYPE.—Male, Tabatiere, Quebec, July 11, 1929 (W. J. Brown); in the Canadian National Collection.

Rhaphium septentrionale, new species

Figure 4

Related to *effilatum* Wheeler but much larger and with three anteroventral and posteroventral bristles apically on the middle femora. Length, 6.5 mm.

MALE.—Face narrow, white; front shining green, from posterior view thinly brownish-gray pollinose; occiput green, grayish-white pollinose, the pile white, the occipital cilia black. Palpi black, of ordinary shape, sparsely black-haired, the anterior border with grayish-yellow pollen and hair. Antennæ black, the third segment subtriangular, gently convex above, about half as long as the face; arista twice as long as the third segment, the apex flattened and slightly broadened. Hair on the eyes black except on the posterior fourth.

Thorax bright green; mesonotum very thinly brownish pollinose; pleura whitish pollinose. Seven dorsocentral bristles; propleural pile white.

Legs reddish yellow, the tarsi except the basal segment of the anterior four, apical fourth of the posterior tibiæ and the apical fifth of the posterior femora except below, black. Coxæ black, cinereous pollinose, white pilose, the middle pair with black bristly hair apically in front except toward the inner edges, behind with thick whitish hair; posterior pair with numerous hairs on the outer surface, the anterior pair without bristles. Femora with short black hair, the anterior four with very short, fine, pale hair beneath; anterior femora with one anterior and three posterior bristles apically, the middle pair with three toward each ventral surface, the posterior pair with two anterior and one posterior. Anterior tibiæ with four anterodorsal and posterodorsal bristles, the middle pair with three, the posterior pair with five. First segment of the front tarsi a little longer than the following two combined, broadened at the apex.

Wings strongly tinged with dark brown. Squamæ yellowish, with white cilia. Halteres yellow.

Abdomen green, the sixth segment purple, the others bronzed on the basal half, thinly whitish pollinose on the posterior half, the sides conspicuously pollinose; venter cinereous-white pollinose. Hair black, the first segment, sides of the second and third and the basal three sternites white-haired. Genitalia black, moderately grayish-brown pollinose; outer lamellæ long, strap-like, tapering apically, the hair long, especially along the outer edge.

FEMALE.—Face wide, silvery gray; front bronzed or coppery; palpi large, yellowish-brown pollinose, the hair all black; third antennal segment smaller. Posterior femora with an elongate brown spot on the apical fifth of the upper surface, their tibiæ with at most the apical sixth blackish; anterior coxæ with several fine black bristles apically. Abdomen less extensively dark, more brightly shining green or bronzed, the pale pollen less obvious.

TYPES.—Holotype, male, and allotype, female, Natashquan, Quebec, August 8, 1929; paratype, female, August 5, 1929 (W. J. Brown). Type in the Canadian National Collection; paratype in The American Museum of Natural History.

Traces to *effilatum* Wheeler in the key (1926, Trans. Roy. Canadian Inst.) but *effilatum* is much smaller, has longer genital lamellæ and less distinctly broadened arista in the male, and only five dorsocentral bristles.

Rhaphium browni, new species

Figures 1 and 2

Related to *foliatum* Curran and *insolitum* Curran; distinguished from both these species by the black median and posterior femora; traces to *banksi* Van Duzee in the key (1926, Trans. Roy. Can. Inst., XV, pp. 252–260) but the third antennal segment is longer than the height of the head in both sexes, the arista a little longer than the third antennal segment and, in the male, ending in a small lamella. Length, 4.75 to 5 mm.

MALE.—Face rather narrow, silvery white, the sides parallel on the lower half; front shining black; occiput greenish black above, black-haired; lower half of the occiput green, whitish pollinose and pilose. Palpi rather small, deep black, truncate at the apex, their short hair black. Antennæ black, elongate; first segment unusually long and broadened, convex on its upper edge, the lower edge gently convex; second segment one-third as long as the first; third segment about equal to the height of the head, very gently tapering from the base to the apex, the base not wider than the second segment; arista as long as the second and third segments combined, terminating in an elongate-oval lamella, the basal section almost one-half as long as the apical section. Eyes with white hair which, however, appears black in some views.

Thorax dark green, the mesonotum blackish and somewhat dulled by brownish pollen except on the broad sides, the pleura cinereous pollinose. Acrostical hairs in two rows; six pairs of dorsocentral bristles; one pair of scutellar bristles, the margin with short hairs. Propleural hair whitish.

Legs black; anterior four tibiæ yellowish, their tarsi yellowish at the immediate base; coxæ cinereous pollinose. Anterior coxæ white-haired, with two black bristles near the apex on the outer side; middle coxæ with a large pencil of short white hair at the apex, preceded by a few short, black bristles and with two black bristles toward the apex on the outer side; posterior coxæ with a row of whitish hairs on the outer surface, near the middle with a strong black bristle, the anterior apex with a few short black bristles, without a pencil of hairs. Anterior femora with short black hair, on the basal third of the ventral surface with cinereous pollen and very short, fine white hair; middle femora with reddish apices, with two bristles on the anterior and posterior surfaces near the apex, the hair black, the basal third of the posterior surface with cinereous pollen and longer whitish hair; posterior femora with short black hair and wholly without preapical bristles. Anterior and middle tibiæ each with three anterodorsal and posterodorsal bristles, the posterior pair with five anterodorsal and three posterodorsal bristles. Basal segment of the anterior tarsi strongly widened at the apex, as long as the two following segments combined.

Wings grayish, with brown tinge in front and along the veins. Squamal cilia white. Halteres yellow.

Abdomen dark green, the venter cinereous pollinose; hair and bristles black, the hair white on the sides of the basal half and on the venter. Genitalia black, the large, broad, foliate, brown posterior lamellæ tapering from near the base to the broad, rounded apex; their hair short and black; inner appendages reddish yellow.

FEMALE.—Face wide, silvery; front steel-blue with purple reflections; palpi large, appressed against the haustellum, subtriangular, thinly brown pollinose, the sparse hair black; mouth-parts very large, cinereous pollinose; arista simple. Posterior femora reddish on the basal half to two-thirds; middle coxæ without thorn, with black hair apically; anterior tarsi simple; wings more strongly tinged with brown. Abdomen dark green, more vivid in color, with more or less bronzed reflection.

TYPES.—Holotype, male, allotype, female, and one female paratype, Natashquan, Quebec, August 7, 1929 (W. J. Brown). Type in Canadian National Collection, paratype in American Museum of Natural History.

The female traces to couplet 2 in the key to females, disagreeing with the first alternative by having the posterior femora reddish on the basal half. It resembles *lugubre* Loew in having the arista less than half as long as the third antennal segment but differs in having the middle femora black. In *lugubre* the arista is about one-third as long as the third antennal segment, in *browni* three-eighths as long.

Rhaphium vanduzeei Curran

1926, Trans. Roy. Canadian Inst., XV, p. 253; 1927, XVI, p. 104.

I have before me a male and female which I believe are this species. They show slight differences from the description: the long, fine hairs on the basal half of the ventral surface of the middle femora are black instead of pale; the anterior four femora are black except on the apical fifth; several of the squamal cilia are black; and there is a black bristle on the outer side of the posterior coxæ. The female agrees perfectly with the description of that sex. I do not have a type specimen before me so am unable to make comparisons in order to discover whether there are other differences. It seems likely that the differences mentioned are within the limits of natural variation, and additional specimens from the same locality might produce intermediate forms.

R. vanduzeei was originally described from Indiana and has not since been recorded. The specimens mentioned above were taken at Arnprior, Ontario, on August 19, 1930, in the same place as *syntormon* *vanduzeei*. It is worthy of note, however, that the male was taken at honeydew on milkweed. It is not uncommon to find species of *Condylostylus*, *Gymnopternus* and *Dolichopus* at honeydew, but this is the first occasion upon which I have found specimens of *Rhaphium*.

Ephydridæ

Ephydra salina, new species

Figure 7

Related to *hians* Say but with dark brown pollen on the face and usually with mostly yellowish-red tibiæ and tarsi. Length, 3.5 to 5 mm.

MALE.—Head longer than high, metallic greenish, brownish-gray pollinose, the face dark brown; frontal orbits brown pollinose, with three or four pairs of divergent orbitals, the shining part of the front with a pair of strong converging bristles and scattered black hairs. Oral border with a row of rather strong bristles, the bristles below the facial ridge not as long as those on the oral border. Proboscis gray pollinose; palpi greenish, with cinereous pollen. Antennæ black; arista short, strongly swollen on less than the basal half, the apical half slender.

Mesonotum greenish or bronzed, rather thinly cinereous pollinose; pleura brownish-yellow pollinose above, cinereous below. Six pairs of dorsocentral bristles, the anterior pair weak. Scutellum with four marginal bristles, and scattered hairs, metallic dark greenish in ground color, with more or less bronzed reflections. Mesopleura with three or four bristles posteriorly.

Legs metallic greenish, the trochanters, apices of the coxæ, tips of the femora, basal third or more of the tibiæ and their apices (rarely almost wholly) and the basal two or three tarsal segments, reddish yellow; the tarsi variable in color, but always reddish basally, the first segment of the anterior pair with dense hair posteroventrally beyond the middle and distinctly widened at this point.

Wings with faint brown tinge, the veins brown, those on the basal half of the wing more or less yellowish. Squamæ yellow, with yellowish fringe. Halteres yellow.

Abdomen metallic greenish, with bronze reflections laterally, moderately cinereous pollinose; hair black.

FEMALE.—Bristles on lower part of ovipositor rather short and fine.

TYPES.—Ten males and eleven females, Cherokee, Okla., July 18, and October 18, 1930 (R. D. Bird). The holotype and allotype (July 18) are in The American Museum of Natural History; paratypes in United States National Museum and University of Oklahoma.

The males, taken on October 18, show certain differences: the legs are greenish with only the bases of the tibiæ reddish; the facial pollen is a very dark brown; and the wing veins are wholly brown. There are no other differences and these represent only a darker form of the same species. The male genitalia are identical in the two forms.

E. salina is closely related to *hians* Say but that species has a cinereous-pollinose face. The original description of *hians* calls for a species with a bluish front, but the species going under the name of *hians*, in collections, has a green front and may not be the same, although teneral specimens are often inclined to be bluish.

Borboridæ

Borborus aptus, new species

Related to *B.* (*Gymnometopa*) *clunicrus* Duda but at once distinguished by the absence of an anteroventral bristle on the middle tibiæ, much longer preapical bristle on the posterior tibiæ, dark reddish sides of the mesonotum, etc. Length, 3 mm.

MALE.—Head rusty reddish, shining, the occiput thinly gray pollinose; vertex a little darkened from anterior view. Frontal triangle not defined, the median rows of bristles not conspicuous, two pairs of weak orbitals; outer verticals as strong as the verticals. Oral vibrissæ elongate, fine. Cheeks only one-fourth as wide as the eye-height; eyes rather oval. Proboscis brownish red. Antennæ luteous; third segment somewhat pointed above; arista black, long pubescent.

Thorax shining castaneous or ferruginous, the mesonotum black, the sides broadly, and sometimes a broad median vitta reddish, the scutellum similarly colored. Hair blackish, moderately long; acrostical hairs in two rows; three pairs of dorsocentral bristles, one in front of the suture; four scutellar bristles, the apical pair arising from small tubercles, the scutellum otherwise bare.

Legs rusty yellowish; apical half or more of the posterior femora, posterior tibiæ except the broad base, apical third or more of the anterior tibiæ, and the basal segment of the posterior tarsi, brownish; tarsi mostly pale yellow. Legs rather hairy, the tibiæ with the hair partly sub-appressed and partly erect; posterior tibiæ with the preapical bristle decidedly longer than the very much thickened tibiæ, the apical spine long and strong. Apex of the first segment of the anterior tarsus produced anteriorly to form a conspicuous, apically rounded spur.

Wings cinereous hyaline, the veins yellowish. Halteres pale yellow.

Abdomen with the first tergite represented only at the sides, the second normal in shape, the third very greatly reduced, the others not at all or incompletely developed. Genitalia large, reddish brown. Sternites normal, the basal ones narrowest. Second tergite rather cinereous pollinose.

FEMALE.—Front tarsi simple; second tergite almost normal, the three following much narrowed, each a little narrower than the preceding, brownish red.

TYPES.—Holotype, male, allotype, female, and two female paratypes, Cameroon, West Africa (Thaxter No. 2732).

Borborus clunicrus Duda was described from East Africa and I consider two females from Liberia (J. Bequaert) as belonging to the species, although they both have the thorax shining black. They also possess a distinct anteroventral bristle on the middle tibiæ, a character lacking in *aptus*. Duda states that the posterior tibiæ of *clunicrus* bear a long preapical bristle, but in the specimens before me this bristle is not as long as the tibial thickness.

AFROBORBORUS, new genus

Related to *Borborus* Meigen but at once distinguished by the greatly elongate, laterally concave scutellum, weak apical spur on the posterior tibiæ, etc. In both sexes the tergites are not developed beyond the second; wing venation complete. The scutellum bears one or two weak, marginal bristles near the middle on either side, but lacks any other hair. The thorax bears only weak bristles: one in front and one behind on the notopleura, one at either end of the posterior calli and a presutural; propleura setose. Head as in *Borborus*.

GENOTYPE.—*Afroborborus tumidus*, new species.

Afroborborus tumidus, new species

Reddish and reddish yellow, the pleura brownish red; pectus and tergites blackish. Length, 3.1 mm.

MALE.—Head shining reddish, the occiput thinly cinereous pollinose; hair and bristles black; interfrontalia with three inwardly directed, fine, short bristles on either side; two pairs of fine, divergent orbitals; ocellars absent; outer verticals as long as verticals. Face concave, the oral margin thin, strongly projecting; oral vibrissæ long; no long bristle on posterior part of the cheeks, which are about one-third as wide as the eye-height. Eyes short oval. Antennæ with the two basal segments and arista brownish; third segment elliptical, obtusely pointed at upper apex, the arista arising just before the tip.

Prothorax, mesonotum and broad base of the scutellum rusty reddish, rather thinly reddish-brown pollinose; pleura shining ferruginous to reddish brown, the pectus black. Acrostical hairs in two rows. Scutellum decidedly longer than wide, obtuse apically, the sides concave on the sub-basal third; apical third brown in color.

Legs reddish yellow; middle tarsi black, the posterior pair with the apical segment brown; apical four segments of the front tarsi whitish. Hair fairly abundant, the tibiæ with some erect hairs, without bristles except the weak preapicals. Spur of the posterior tibiæ very small.

Wings cinereous hyaline; fifth vein continued to the wing margin; second vein strongly curved forward apically. Squamæ black ciliate. Halteres pale yellow.

First two abdominal segments black, cinereous-brown pollinose; genitalia similarly colored; remainder of abdomen yellowish, the tergites not hardened, the sternites but poorly defined; hair black.

FEMALE.—Legs wholly reddish yellow; abdomen wholly yellowish beyond the second segment.

TYPES.—Holotype, male, and allotype, female, Cameroon, Thaxter No. 2734.

Diopsidæ

Diopsis globosa, new species

Differs from *macquarti* Guérin in having the abdomen wholly shining reddish-brown or black; in *macquarti* the fourth, fifth and sixth segments are cinereous pollinose. Length, 5.5 to 7 mm.; width of head, 4 to 5.75 mm.

MALE.—Head dark reddish; front with a broad median area which usually shows weak, transverse, curved grooves, and on either side with a large area, beginning in front, bearing fine, irregular longitudinal ridges. Bristle of the eye-stalks minute, the postocular bristle strong; eye-stalks black apically. Antennæ reddish. Face wider above than below, transversely striate, armed below with small, perpendicular teeth; in profile more strongly convex below, the lowest fourth of the face most prominent. Hair short and fine.

Thorax black, moderately cinereous pollinose, sometimes slightly brownish. Scutellum and spines brown or reddish brown.

Legs reddish yellow or reddish, the apical third of the posterior femora and the posterior tibiæ more or less reddish brown. Anterior femora moderately swollen, with black ventral setæ on the apical three-fifths. Middle and posterior femora with small apical spines.

Wings hyaline and brown; behind the tip of the first vein with a narrow transverse spot which is weakly connected through the first basal cell with the brown surrounding the end of the anal cell. Beyond the clear band at the middle of the wing is a very large, interiorly and exteriorly convex brown area which reaches both the anterior and posterior border of the wing very broadly and extends beyond both the anterior and posterior cross-veins. The hyaline cross-band beyond the median brown field is relatively narrow and is separated from the grayish or very pale brownish apex of the wing by a narrow, irregular brown band, the anterior section of which, lying in front of the second vein, is not connected with the posterior part. Halteres pale yellow.

Abdomen varying from black to ferruginous, wholly shining, the sides of the second segment basally more or less transversely aciculate. The abdomen is cylindrical basally and globosely enlarged on the apical half, although, as a rule, in the male the enlargement is more oval than in the female.

Female.—The abdomen is more globosely enlarged apically.

Types.—Six specimens of each sex from Cape Colony: Barberton, August 1913 and May 21, 1914 (L. S. Hardenberg); Worcester, May 20, 1914, and Barberton, da Kaap Farm, October 6, 10, 1919 (H. K. Munro); male, Kissanter, Congo, September 1920 (P. Vanderijst). The holotype, male, and allotype were taken at Barberton on October 6, 1919. Paratypes are in the Musée du Congo Belge and Mr. Munro's collection.

The specimen from the Congo has the middle and hind femora much darker than in the South African examples.

Agromyzidæ

Phytomyza dura, new species

Black, with cinereous pollen, the face, cheeks, front, knees and halteres yellowish, Length, 2 mm.

Female.—Face and cheeks yellowish, the orbits cinereous pollinose, front wider than long, yellowish, the vertex black; orbits broad, cinereous pollinose; three pairs of frontal bristles, the anterior pair more or less convergent; outside the frontals with a row of tiny setulæ; ocellars, postocellars, verticals and outer verticals strong. Occiput black or brown in ground color, cinereous pollinose, the hair and occipital cilia black. Cheeks one-third as wide as the eye-height, the lower border with a row of fine bristles. Vibrissæ moderately strong. Palpi black or brown. Antennæ black, rather small; third segment orbicular, with obscure pubescence; arista thickened on the basal two-thirds, tapering apically, not conspicuously pubescent.

Thorax rather thickly cinereous pollinose; four pairs of strong dorsocentrals and five to seven pairs of acrostical hairs. Scutellum with two pairs of strong marginal bristles.

Legs blackish or brown; coxæ cinereous pollinose; apices of the femora and the narrow bases of the tibiæ reddish yellow.

Wings cinereous hyaline; veins brown, at the base yellowish brown. Auxiliary vein weak on most of its length; second, third, and fourth costal sections as 3–1–1½ to 2. Squamæ with blackish border and fringe. Halteres whitish yellow.

Abdomen blackish, thinly cinereous-brown pollinose, sub-shining, the extreme apices of the segments appearing yellowish from posterior view. Ovipositor large, shining black. Hair and bristles black.

TYPES.—Holotype, female, and three female paratypes, Thunder Bay and Thunder River, Quebec, June 11, 1929 (W. J. Brown). The type is in the Canadian Nation Collection, paratypes in The American Museum of Natural History.

This species traces to *lactuca* Frost in Frost's key (Cornell University Agric. Exp. Sta. Mem. 78, pp. 60–62) but differs in many respects. *P. lactuca* has two rows of setæ outside the frontal bristles, the front about as broad as long, the third antennal segment is broadest toward the apex and is thickly long whitish pubescent, etc.

Muscidæ

Cordilura masconina, new species

Figure 6

Related to *latifrons* Loew but with yellow palpi, longer front and darker pollen on the mesonotum. Length, 5 to 5.25 mm.

MALE.—Face, cheeks, and frontal vitta reddish yellow, the parafrontals of the same color anteriorly; head cinereous-white pollinose. Occiput black. About ten pairs of frontal bristles; ocellars moderately long; verticals long, the outer verticals well developed. Occipital hair whitish on the lower half. Cheeks narrow; face strongly receding below, the vibrissæ strong. Palpi yellow, pale-haired, the apical bristle black. Proboscis black. Antennæ black, the second segment reddish dorsally beyond the bristle; third segment about as long as the second, rounded apically, the upper apex more sharply rounded; arista with moderately long hair on the basal half.

Thorax black, brownish-gray pollinose, in some lights with four darker vittæ. Acrostical hairs rather coarse, arranged in a single, irregular row; dorsocentrals 2–3; scutellum with one pair of strong bristles, a pair of apical bristly hairs and a few hairs toward either side. Pleural hair pale yellowish, the bristles black.

Legs black, the tibiæ and basal two tarsal segments reddish yellow; coxæ and femora cinereous pollinose. Hair black, pale yellowish on the coxæ and ventral surfaces of the femora.

Wings cinereous hyaline. First vein with several setulæ apically. Squamæ and halteres yellowish.

Abdomen black, cinereous pollinose, less thickly so on the dorsum. Fifth sternite cleft V-shaped, the broad, apically rounded lobes lying parallel to each other, very thinly pollinose. Genitalia black, cinereous pollinose. Outer forceps shining brown, on the inner side with a broad, truncate lobe, the apex of the forceps rather pointed (figure 6). Abdominal hair and bristles black, the venter with pale yellowish hair.

TYPES.—Holotype, male, and three male paratypes, Masconin, Quebec, June 20, 1929. Type in the Canadian National Collection; paratypes in The American Museum of Natural History.

In some respects this species is intermediate between *Cordilura* Rondani and *Acicephala* Coquillett. The face is almost as much receding as in *Acicephala polita* Coquillett, but the eyes are less oblique, the occiput being very considerably narrower; the front bears more numerous bristles than *polita* and the head is slightly shorter. Were it not for the narrow occiput I should be inclined to place the species in *Acicephala*.

Cordilura browni, new species

Figure 5

Black, cinereous pollinose; legs yellowish. Length, 5.25 mm.

MALE.—Face and cheeks whitish; front orange, the parafrontals on the upper three-fifths and the ocellar triangle black in ground color. Seven pairs of frontals; ocellars of moderate length; verticals long, the outer verticals poorly developed. Front twice as long as wide, gently narrowing anteriorly, gently convex in profile. Occiput black, cinereous pollinose; whitish below the level of the eyes, pale yellow-haired on the lower half. Face only slightly receding below, the vibrissæ strong. Proboscis rusty reddish. Palpi very pale yellow, with two or three long yellowish hairs on the outer margin, a black apical bristle and several very short black hairs on the dorsal surface. Antennæ pale orange, the third segment black on about the apical half; arista black, with moderately long rays.

Thorax black in ground color, cinereous pollinose, the mesonotum without vittæ. Acrosticals short, in two rows; dorsocentrals 2–3, both the anterior presutural and postsutural short; one intra-alar present; one pair of strong scutellars and three or four hairs toward either side (probably a pair of weak apicals present since there appear to be two scars, indicating that they have been broken off). Hair of the pleura pale yellowish.

Legs reddish yellow; posterior four coxæ reddish, their outer surfaces brown. Anterior coxæ, anterior femora below and the posterior four femora on the base of the under surface, pale yellow pilose, the hair and bristles on the remainder of the legs black. Tarsi becoming brownish apically.

Wings cinereous hyaline, tinged with luteous anteriorly and basally, the veins partly luteous. First vein wholly bare. Squamæ and halteres yellow.

Abdomen black, moderately cinereous pollinose, the dorsal hair and bristles black; first segment, lateral margins and venter with pale yellowish hair. Lobes of the fifth sternite broadly reddish basally, shining brown apically, their sides almost parallel, their apices broadly rounded, the hair partly black and partly yellow. Posterior and outer forceps reddish yellow, the outer pair ending in a small, flat, narrow process before which the lobes are very broadly, truncately widened on the inner sides (figure 5).

TYPE.—Male, Bradore Bay, Quebec, July 27, 1929 (W. J. Brown). The type is in the Canadian National Collection.

Mydæa triseta, new species

This species resembles *Cyrtoneuropsis veniseta* Stein, having very similar wing markings, but since it bears only three pairs of postsutural dorsocentral bristles and has the wing veins bare it is readily distinguished. In Stein's key it traces to *spiloptera* Wiedemann but that species has the prosternum haired and belongs to *Cyrtoneura* Giglio-Tos. Length, 6 to 7.5 mm.

MALE.—Head blackish, cinereous pollinose; cheeks reddish above; frontal vitta brownish red, obliterated for a short distance above the middle; two pairs of strong frontals in front, and five or six very short ones; ocellars long; verticals very weak; occiput black-haired, the hair yellowish and fine behind the oral opening; cheeks one-seventh as wide as eye-height. Palpi reddish. Antennæ orange. Eyes sparsely short-haired. Arista long plumose.

Thorax brown, cinereous pollinose; mesonotum with four rather narrow brownish vittæ, the outer ones interrupted at the suture; scutellum darker in the middle. Dorsocentrals 2–3, all strong; anterior intra-alar present; prealar long and strong; sternopleurals 1–2; hypopleura without hairs.

Legs blackish; apices of the femora and the tibiæ reddish. Anterior tibiæ without bristles; middle pair with one posterior, situated beyond the middle; posterior tibiæ with two anterior, two anterodorsal and one posterodorsal, the latter not longer than the others and situated at the apical third. Posterior femora with an entire anterodorsal row of bristles and three near the apex on the anteroventral surface, the middle one strong.

Wings cinereous hyaline, with brown markings as follows: the costal cell beyond and behind the auxiliary vein, broad clouds surrounding the cross-veins, a brown cloud extending from the costa to behind the second vein beyond the posterior cross-vein and clouds along the third and fourth veins beyond the apex of the second vein. Third vein gently arched forward, almost parallel with the fourth vein for some distance before its apex, the tip itself curved forward; fourth vein practically straight. Third vein with two setæ at the base above and three or four below. Squamæ yellowish. Halteres yellowish, with reddish knob.

Abdomen brown, cinereous pollinose, somewhat tessellate, but usually displaying an elongate oval spot on the second and third segments forming a longitudinal vitta. The hairs arise from dark spots. Third and fourth segments each with a row of marginal bristles, the fourth with a row of discals. Basal sternite bare.

TYPE.—Male, Chapada, Brazil (Williston Collection).

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BRIEF DIAGNOSES OF TWENTY-SIX APPARENTLY NEW FORMS OF *MARMOSA* (MARSUPIALIA) FROM SOUTH AMERICA

BY G. H. H. TATE

In course of preparation of my revisional paper on *Marmosa* which is pending publication, a number of apparently distinct forms—mainly subspecies—have been noted and are described below. I am greatly indebted to the authorities of the various museums indicated, who have the material in their charge, for their permission to study their collections.

To Mr. M. A. C. Hinton, British Museum, Dr. W. H. Osgood, Field Museum of Natural History, Chicago, Dr. H. Pohle, Zoologisches Museum, Berlin, and Mr. P. G. Redington, U. S. Biological Survey I am especially grateful for permission to describe new forms. Particularly am I indebted to Mr. H. E. Anthony, curator of mammals in The American Museum of Natural History, for permission to revise this genus and to make use of material which he has been securing for the department and would otherwise have described himself.

Marmosa cinerea paraguayana, new subspecies

TYPE.—No. 25.5.1.15, British Museum; male, ad.; Villa Rica, Paraguay; collector, Shade. The type is a skin and skull in good condition; in British Museum.

GENERAL CHARACTERS.—A large member of the *cinerea* group with longer pelage and broader skull than in true *cinerea*.

DESCRIPTION.—Color above a very clear mouse gray[1] with no admixture of brownish; ventrally with the tips of the hairs deep yellow-buff through which little of the gray of the lateral gray-based hairs shows. Inguinal and gular regions self-colored and connected by a narrow self-colored stripe. Tail nearly half as long again as head and body, particolored.

Skull with broadly expanded zygomata which are evenly arched. Supraorbital ridges strongly developed and forming angular processes. These processes placed as in *cinerea*. Palate short and broad. Bullæ large and smooth.

MEASUREMENTS.—Taken from dried skin: length of head and body, 160 mm.; length of tail vertebræ, 220; length of hind foot (c.u.), 27; skull measurements not taken.

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[1] Color nomenclature after Ridgway.

Other material which I refer to this subspecies is that from Lagoa Santa and Santa Catharina. The range of *cinerea paraguayana* includes approximately the southern part of Brazil and eastern Paraguay.

Cinerea paraguayana is to be distinguished from *cinerea cinerea* (Temminck) principally through the pelage characters cited above, and the proportionately broader and shorter form of skull and palate.

Marmosa demararæ areniticola, new subspecies

TYPE.—No. 75691, Amer. Mus. Nat. Hist.; male, ad.; Arabupu, foot of Mt. Roraima, Venezuela, 4200 feet; December 29, 1927; collectors, Tate and Carter. The type is a skin and skull in good condition; in American Museum.

GENERAL CHARACTERS.—A rather small form of *demararæ* with longer, denser, grayer pelage.

DESCRIPTION.—Color above browner than hair-brown and darker and grayer than sepia—the shade being accounted for by the cinnamon-yellow tips of the hairs resting upon their slaty basal parts. Underparts between cartridge buff and cream buff, darkening on neck, throat, chin and cheeks to chamois. Eye-rings broad and very black. Tail long, the distal half white, the basal furry part of tail 33 mm. in length. The individual hairs of base of tail very long and fluffy.

Skull scarcely distinguishable from that of true *demararæ*. Palate usually without posterior vacuities. Bullæ rather large and smoothly rounded.

MEASUREMENTS.—Taken in the flesh: length of head and body, 163 mm.; length of tail vertebræ, 239; length of hind foot (c.u.), 29; basal length of skull, 38.1; zygomatic breadth, 23.0; length of M^{1-3}, 7.4.

This appears to be a local race of *demararæ* which is probably confined to the vicinity of the Roraima upland savannas. The subspecies is based upon a series of eight specimens, all from Arabupu.

Marmosa demararæ esmeraldæ, new subspecies

TYPE.—No. 76964, Amer. Mus. Nat. Hist.; male, old ad.; Esmeralda, near foot of Mt. Duida, upper Rio Orinoco, Venezuela, 325 feet; October 7, 1928; collector, G. H. H. Tate. The type is a skin and skull in good condition; in American Museum.

GENERAL CHARACTERS.—The largest known form of *Marmosa;* the adult males occasionally develop a sagittal crest on skull.

DESCRIPTION.—Pelage dense, lax, generally slightly wavy, above mouse gray with a brownish suffusion. Face and sides lighter, tinged with russet. Underparts pale rusty buff, near cinnamon buff. Basal 40 mm. of tail with moderately long hairs.

Skull very strongly constructed, with well-expanded zygomata. Supraorbital processes large, strongly pointed, abruptly narrowed behind at the very pronounced postorbital constriction. Temporal ridges in type not actually forming a crest. Pelage long and broad with long posterior foramina.

MEASUREMENTS.—Taken in the flesh: length of head and body, 202 mm.; length of tail vertebræ, 264; length of hind foot (c.u.), 32; basal length of skull, 44.3; zygomatic breadth, 26.6; length of M^{1-3}, 7.7.

The specimen in which the sagittal crest is developed is A. M. N. H. 76974. Females are much smaller than males and never develop such pronounced cranial characters.

The subspecies is based upon eighteen specimens, all of which come from the neighborhood of Mt. Duida and the Casiquiare Canal. One specimen was taken as high as 6200 feet.

Marmosa demararæ meridæ, new subspecies

TYPE.—No. 137510, U. S. Biol. Surv.; male, old ad.; "Cafetos de Mérida," Mérida, 1630 meters; June 14, 1904; collector, Briceño Gabaldon. The type is a skin and skull in fair condition; in collection of U. S. Biological Survey.

GENERAL CHARACTERS.—Essentially as in true *demararæ*, but with decidedly coarser and harsher pelage than in any of the other three subspecies.

DESCRIPTION.—Color above near bistre or sepia, the caudal fur becoming strongly brownish. Face light drabbish gray. Underparts a dirty grayish shade of cream buff deepening on neck, chin and cheeks to chamois. Unicolorous hair (with gray bases) on chin and cheeks only. Eye-rings grayish black, narrowed beneath eyes.

Skull of type barely distinguishable from *demararæ* and with rather broad zygomata, well-developed and pointed supraorbital processes and considerable postorbital constriction. Palate broad, short, with accessory vacuities. Under surface of bullæ with slight tendency to become pointed.

MEASUREMENTS.—Taken from dried skin: length of head and body, 180 mm.; length of tail vertebræ, 240; length of hind foot (c.u.), 31; basal length of skull, 41.5; zygomatic breadth, 25.3; length of M^{1-3}, 7.5.

The subspecies is based upon thirty-two specimens almost all of which were collected by Gabaldon in the Mérida region and may be found throughout the collections of the world's museums. The distribution appears to extend westward along the Orinoco side of the Andes into Colombia. Although there are at present no connecting forms between this subspecies and those of the Guiana region, it is probable that such will eventually be found. I would emphasize that the above three subspecies, together with *demararæ demararæ*, represent in my opinion regional forms of one widely distributed species. However, my studies of this species have convinced me that these races are true indications of local geographic conditions and for that reason I think may be accorded subspecific rank.

Marmosa mapiriensis, new species

TYPE.—No. 72555, Amer. Mus. Nat. Hist.; male, old ad.; Ticunhuaya, road from Sorata to Guanay, Tipuani River, Provincia de la Paz, Bolivia, 4800 feet; April 23, 1926; collector, G. H. H. Tate. The type is a skin and skull in good condition; in American Museum.

GENERAL CHARACTERS.—A member of the *cinerea* group with long appressed fur and extremely short tail.

DESCRIPTION.—Fur slightly wavy. General color above near hair brown with face very little paler. Underparts near cinnamon buff, washed with vinaceous cinnamon at throat and chin. Self-colored hairs found only in a narrow strip 4 mm. in width from throat to lower chest. Tail very short, indistinctly particolored, the basal brown color extending in blotches well towards the tip.

Skull broad and blunt, with well-developed supraorbital processes. Bullæ small and rather strongly pointed beneath. Nasals with the abrupt expansion at the maxillo-frontal suture seen in *constantiæ*. Temporal ridges not approximated. Palate short, possessing accessory openings.

MEASUREMENTS.—Taken in the flesh: length of head and body, 162 mm.; length of tail vertebræ, 202; length of hind foot (c.u.), 26; basal length of skull, 37.8; zygomatic breadth, 24.3; length of M^{1-3}, 7.2.

This species is based upon six specimens, all of which come from the eastern slopes of the Cordillera Real, Bolivia, at altitudes between 2000 and 8000 feet. The general structure of the skull, together with the short tail, suggests relationship with *constantiæ*, which extends from the Matto Grosso to the Santa Cruz region of Bolivia. At approximately the headwaters of the Inambari River *mapiriensis* is replaced by the Peruvian *rapposa* which is larger and has a longer tail with much white distally and with coarser, more fuzzy hair at its base.

Marmosa germana parda, new subspecies

TYPE.—No. 24140, Field Mus. Nat. Hist.; male, ad.; Huachipa, mouth of Rio Cayumba, upper Rio Huallaga, Peru, about 3000 feet; September 28, 1922; collector, J. T. Zimmer. The type is a skin and skull in good condition; in Field Museum.

GENERAL CHARACTERS.—A mountain form nearest to *germana rutteri* but with longer pelage and with underparts between yellow and ochreous.

DESCRIPTION.—Brownish gray above becoming brownish on face and sides, ventral color nearest to cinnamon buff. Chin, throat, cheeks, neck and an extremely narrow median line, unicolorous. Tail fuscous.

Skull not distinguishable from that of *germana rutteri*.

MEASUREMENTS.—Taken in the flesh: length of head and body, 171 mm.; length of tail vertebræ, 235; length of hind foot (c.u.), 28; basal length of skull, 40.4; zygomatic breadth, 25.0; length of M^{1-3}, 7.5.

Sixteen specimens, all collected in the Huallaga drainage between 2500 and 6000 feet, are assigned to this subspecies. Notable among them are the three specimens in the British Museum from Chinchivita, Nos. 27.11.1.245 to 247, which have the color of the underparts deep brownish yellow.

Marmosa murina roraimæ, new subspecies

TYPE.—No. 75703, Amer. Mus. Nat. Hist.; male, ad.; Arabupu, foot of Mt. Roraima, Venezuela, 4000 feet; December 25, 1927; collectors, Tate and Carter. The type is a skin and skull in good condition; in American Museum.

General Characters.—The locally specialized form of *murina*, distinguishable on account of its long dense pelage which lacks the reddish tint of most subspecies and is separable from its nearest ally, *murina muscula* of the lowlands of British Guiana, through the total lack of natal brown.

Description.—Dorsal color nearest to bistre. Underparts not varying from cream-color and little or not at all narrowed by gray-based hairs. Pelage soft, long and smooth-lying.

Skull not distinguishable from that of *muscula*, with well-developed supraorbital processes, convergent toothrows and well-rounded bullæ of moderate size.

Measurements.—Taken in the flesh: length of head and body, 122 mm.; length of tail vertebræ, 184; length of hind foot (c.u.), 22; basal length of skull, 31.2; zygomatic breadth, 19.9; length M^{1-3}, 5.9.

Murina roraimæ, represented by a series of fourteen specimens from Arabupu, is to be regarded as a local mountain-inhabiting form of *murina*. Doubtless with further collecting it will be found that this race intergrades with *muscula*, *madeirensis*, *duidæ*, and *klagesi*, the four subspecies which surround it, but the characters set forth appear sufficiently characteristic to be worthy of subspecific separation.

Marmosa murina duidæ, new subspecies

Type.—No. 76984, Amer. Mus. Nat. Hist.; male, old ad.; "Middle Camp," foot of Mt. Duida, eight miles north of Esmeralda, upper Rio Orinoco, southern Venezuela, 350 feet; February 3, 1929; collectors, Olalla y hermano. The type is a skin and skull, the latter in rather a fragmentary condition; in the American Museum.

General Characters.—A *murina*-like form distinguished in adults by its markedly narrow palate.

Description.—Color above natal brown, the face paler. Underparts dirty buff, the hairs from chin to behind forelimbs self-colored. Ears large, dark fuscous. Feet heavy and broad, tail long, unicolorous.

Skull heavily constructed for the species, elongate, narrow-muzzled, with zygomata well expanded. Palate very long and toothrows more parallel than in most members of the *murina* section of *Marmosa*. Canines very thick, long, oval in cross-section. Anterior edge of coronoid perfectly straight.

Measurements.—Taken in the flesh: length of head and body, 135 mm.; length of tail vertebræ, 192; length of hind foot (c.u.), 24; basal length of skull 35.1; zygomatic breadth, 21.1; length M^{1-3}, 6.1.

This subspecies is based upon five specimens taken in the upper Orinoco basin near Mt. Duida. It will probably be found that it intergrades imperceptibly with *murina klagesi* of the lower Orinoco on the one hand and on the other hand with *murina madeirensis* of the lower Rio Negro and middle Amazon. From *murina roraimæ* it is separated by its thinner rather shorter pelage, greater size in adulthood, greater suffusion of reddish, and by the cranial characters mentioned above.

Marmosa rubra, new species

TYPE.—No. 71973, Amer. Mus. Nat. Hist.; female, old ad.; mouth of Rio Curaray, Province of Oriente, Ecuador; December 7, 1925: collectors, Olalla y hermano. The type is a skin and skull in fair condition; in American Museum.

GENERAL CHARACTERS.—A very large cinnamon-brown member of the *murina* group.

DESCRIPTION.—Color above between chestnut and burnt sienna, beneath near ochraceous buff. Self-colored hairs from throat to chest arranged in an irregular stripe about 1 cm. in width. A much narrower line of irregularly placed areas of creamy hairs accompany the stripe. Face somewhat paler than dorsum, with very narrow but defined median reddish-fuscous line from rhinarium to brow. Eye-ring much reduced behind and below eye. Ears small, fuscous. Feet large, with stout claws. Tail dark fuscous above, lighter beneath.

Skull short and broad, with widely expanded zygomata. Postorbital region broad and much less constricted than in any other form of the *murina* group. Supraorbital processes not pointed but reduced to fine raised beading. Toothrows rather strongly convergent and canines short.

MEASUREMENTS.—Taken from dried skin: length of head and body, 140 mm.; length of tail vertebræ, 190; length of hind foot (c.u.), 22; basal length of skull, 32.2; zygomatic breadth, 21.3; length M^{1-3}, 6.3.

Rubra is based upon twelve specimens collected at the type locality and at San José Abajo, Mt. Sumaco, eastern Ecuador. The species, whose nearest relative is *murina*, appears to be strongly differentiated.

Marmosa tyleriana,[1] new species

TYPE.—No. 76983, Amer. Mus. Nat. Hist.; female, young ad.; "Central Camp," Mt. Duida Plateau, upper Rio Orinoco, Venezuela, 4800 feet; February 6, 1929; collectors, Olalla y hermano. The type is a skin and skull in good condition; in American Museum.

GENERAL CHARACTERS.—A small member of the *murina* group, about equal in size to *quichua*, but with the long shaggy pelage and vinaceous underparts of *dryas*.

DESCRIPTION.—Color above near russet with something of the mottled appearance of *marica*. Hair long and lax above and below. Face scarcely paler than dorsum. Underparts near fawn color, hairs everywhere gray-based except inguinal area which is rusty vinaceous. Ears large and deeply pigmented. Throat gland absent. Tail of moderate length, its basal half fuscous brown, its distal half creamy.

Skull elongate, narrow. Muzzle relatively broad. Zygomatic arches narrow. Supraorbital ridges barely noticeable. A distinct postorbital constriction. Palate long and narrow. Bullæ large, smoothly rounded, without processes.

MEASUREMENTS.—Taken in the flesh: length of head and body, 115 mm.; length of tail vertebræ, 171; length of hind foot (c.u.), 20; basal length of skull, 29.5; zygomatic breadth, 17.0; length of M^{1-3}, 5.7.

This species, of which a second specimen, a juvenile male, was taken on the same plateau at 6900 feet, appears to be peculiarly a product of the highly specialized environmental conditions of the summit of Mt. Duida.

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[1] Dweller in *Tyleria* forests on plateau of Mt. Duida; *Tyleria* is proposed in honor of Mr. S. F. Tyler, Jr., who generously financed the expedition to Mt. Duida.

Marmosa yungasensis, new species

Type.—No. 72558, Amer. Mus. Nat. Hist.; female, old ad.; Pitiguaya, Rio Unduavi, Yungas, Bolivia, 5600 feet; May 10, 1926; collector, G. H. H. Tate. The type is a skin and skull in good condition; in American Museum.

General Characters.—A subtropical species allied to the narrow-skulled *noctivaga* with long fine pelage and clear white underparts. Skull with unusually short canines for the *noctivaga* group.

Description.—Median region of back darkest, near natal brown, paling gradually to russet on sides. Face slightly paler than back. Ocular mark well-developed. Underparts pale creamy white, the hairs self-colored even at the sides, the white area narrowed slightly in the costal region and at the neck. Feet unusually small and slender. Tail quite densely fine-haired throughout. Throat gland moderately developed, dorsal pelage length 9–10 mm.

Skull rather lightly ossified, the molars smaller than in *noctivaga* and *dorothea.* A sharp supraorbital ridge without definite beading.[1]

Measurements.—Taken in the flesh: length of head and body, 136 mm.; length of tail vertebræ, 169; length of hind foot (c.u.), 17; basal length of skull, 33.0; zygomatic breadth, 18.4; length M^{1-3}, 5.7.

This species is represented by eight specimens, all of which were taken at the type locality.

Marmosa ocellata new species

Type.—No. 26.1.5.25, British Museum; male, old ad.; Buenavista, Department of Santa Cruz, Bolivia, 500 meters; August 6, 1924; collector, José Steinbach. The type is a skin and skull in good condition; in British Museum.

General Characters.—A member of the *noctivaga* group, rather larger than *leucastra* and very similarly colored but differing in possessing strongly developed eye-rings, narrowed interorbital region and much smaller molar teeth.

Description.—Color above between light drab and hair brown, becoming slightly cinnamon on sides. Face paler than dorsum. Eyes surrounded by black which extends backward almost to the base of the ear. Ventral pelage pale white, a few gray-based hairs at junction with dorsal color. Feet buffy white, tail slightly bicolor, decidedly particolored, but distal one-third to one-fifth whitish and the entire tail clothed with fine white hairs. Ears large, semitranslucent, profusely haired terminally. Throat gland well developed.

Skull heavily built but scarcely of characteristic appearance of the *noctivaga* group on account of the supraorbital region which is narrow and, being merely angled, lacks prominences or beading. Molars very small, palate relatively narrow.

Measurements.—Taken from dried skin: length of head and body, 140 mm.; length of tail vertebræ, 186; length of hind foot (c.u.), 21; basal length of skull, 33.9; zygomatic breadth, 20.0; length of M^{1-3}, 5.7.

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[1] There is an indication in young males that beading will form with age.

This form, which is rare in collections, is based upon five examples all from Buenavista, distributed between the British Museum and the Carnegie Museum, Pittsburgh. I am inclined to think that *ocellata* is an annectant form not only geographically but morphologically between *noctivaga* and *incana*.

Marmosa incana bahiensis, new subspecies

TYPE.—No. 3.9.5.137, British Museum; male, ad.; Lamarão, Bahia, Brazil, 1903; collector, A. Robert. The type is a skin and skull, the latter slightly broken; in British Museum.

GENERAL CHARACTERS.—Very near true *incana* with similar coloration and similar differences in length of pelage in the sexes; distinguished by its proportionately longer molar toothrows and the absence of any trace of modification of the gular hairs of males.

DESCRIPTION.—Color above mouse gray to benzo brown, beneath clear creamy white. Fur very soft and lax, tail proportionately short.

Skull smaller than in true *incana* but essentially similar, with the exception of the length of the toothrow. Coronoid appressed, not strongly inclined to dentary.

MEASUREMENTS.—Taken in the flesh: length of head and body, 135 mm.; length of tail vertebræ, 166; length of hind foot (c.u.), 21; basal length of skull, —; zygomatic breadth, 18.7; length of M^{1-3}, 6.3.

The subspecies is based upon ten specimens, all of which were captured by Mr. Robert in Lamarão.

Marmosa incana paulensis, new subspecies

TYPE.—No. 26576, Field Mus. Nat. Hist.; male, young ad.; Therezopolis, Rio de Janeiro, São Paulo, Brazil; collector, C. C. Sanborn. The type is a skin and skull, the latter slightly damaged.

GENERAL CHARACTERS.—Somewhat smaller than *incana incana* and *incana bahiensis*, with much smaller ears and with the hairs of the throat in males little or not at all modified.

DESCRIPTION.—Color above gray with a slight brownish wash considerably darker than the northern forms. Underparts ivory white. No distinction in length of pelage between sexes.

Skull with teeth larger than those of true *incana* and about equal in size to those of *bahiensis*. Canines short. Bullæ rather well inflated compared with those of *incana*.

MEASUREMENTS.—Taken in the flesh: length of head and body, 132 mm.; length of tail vertebræ, 150; length of hind foot (c.u.), 21; basal length of skull, —; zygomatic breadth, —; length of M^{1-3}, 6.2.

The subspecies is based upon eleven specimens which come from the Provinces of São Paulo and Parana. All three forms of *incana*, although anatomically distinguishable, are very closely allied, and further collecting may reveal considerable intregradation between them.

Marmosa caucæ albiventris, new subspecies

TYPE.—No. 194378, U. S. Nat. Mus.; male, ad.; Torontoy, near Cuzco, Peru, 8000 feet; April 30, 1915; collector, E. Heller. The type is a skin and skull in good condition; in U. S. National Museum.

GENERAL CHARACTERS.—Very closely allied to *caucæ madescens* but disinguished by the pure white underparts.

DESCRIPTION.—Color above identical with that of *madescens*. Ventral color white to the bases of the hairs from chin to vent, with the exception of an asymmetrical spot of gray-based hairs 10 mm. in width just behind the left arm, and a slight reduction of the average width in the mid-ventral region from 22 mm. to 16 mm. Tail as in *madescens*.

The skull, which shows characters of full adulthood, is essentially like that of *caucæ madescens;* minute beading of the supraorbital region is developed and the bullæ seem very slightly smaller.

MEASUREMENTS.—Taken in the flesh: length of head and body, 105 mm.; length of tail vertebræ, 144; length of hind foot (c.u.), 18; basal length of skull, 27.5; zygomatic breadth, 16.1; length of M^{1-3}, 5.8.

Probably the increase of white in the ventral color pattern is related to local conditions of dryness at Torontoy.

Marmosa caucæ ucayaliensis, new subspecies

TYPE.—No. 78952, Amer. Mus. Nat. Hist.; male, young ad.; Lagarto, Rio Ucayali, eastern Peru; March 20, 1928; collectors, Olalla y hermano. The type is a skin and skull in fair condition; in American Museum.

GENERAL CHARACTERS.—The lowland representative of *caucæ*, closest to *purui*, characterized by unusually short fur ventrally and by exceedingly small compressed bullæ.

DESCRIPTION.—Color of the type fuscous dorsally. Underparts with self-colored area 10 mm. in width (broader in other specimens), creamy white. Feet light buff; ears and tail fuscous.

Skull resembling that of *caucæ madescens* except in the bullæ, which are much more compressed. The skull differs from that of *purui* in its shorter distance from palate to bulla. Canines moderately long.

MEASUREMENTS.—Taken from dried skin: length of head and body, 110 mm.; length of tail vertebræ, 145; length of hind foot (c.u.), 19; basal length of skull, 28.0; zygomatic breadth, 16.2; length of M^{1-3}, 5.6.

The material upon which this subspecies is based amounts to twenty-five specimens. It is derived from various camps in the lower Ucayali drainage and on the Pachitea. Three specimens from the mouth of the Rio Curaray, Ecuador, although slightly larger, are also assigned to *ucayaliensis*. The range of the species appears to extend northward from the Ucayali to the lower Napo River in Ecuador and to be bounded on the east by the range of *caucæ purui* and on the west by that of various mountain-inhabiting forms of *caucæ*.

Marmosa microtarsus guahybæ, new subspecies

TYPE.—No. 4306, Zoologisches Museum, Berlin; male, young ad.; Island of Guahyba near Porto Alegre, Rio Grande do Sul, Brazil; collector, Hensel. The type is a skin and skull in fair condition; in Berlin Museum.

GENERAL CHARACTERS.—A very small representative of *microtarsus*, slightly paler in color.

DESCRIPTION.—Color above rather pale cinnamon, the face still paler. Hairs of underparts gray-based from the chest posteriorly. Face, chest and throat self-colored. Color of underparts a rather deep buff with chin whitish. Eye-ring narrowed or absent beneath eye. Vibrissæ rather short; feet very small, light brownish buff. Tail slightly bicolored.

Skull rather narrower than *m. microtarsus* (probably an age character). Supraorbital parts smoothly rounded; bullæ with only a suggestion of an anterior process. Teeth very small.

MEASUREMENTS.—Taken from dried skin: length of head and body, 70 mm.; length of tail vertebræ, 100; length of hind foot (c.u.), 15; basal length of skull, 21; zygomatic breadth, 13.3; length M^{1-3}, 4.6.

Guahybæ, represented by nine specimens from Rio Grande do Sul, is considered by me to be a southern representative of typical *microtarsus* which occurs in the Provinces of São Paulo, Parana, and Santa Catharina. As in *microtarsus*, both pectoral and inguinal mammæ are developed.

Marmosa agilis chacoensis, new subspecies

TYPE.—No. 4.1.5.48, British Museum; male, young ad.; Sapucay, Paraguay; September 11, 1903; collector, W. Foster. The type is a skin and skull in good condition; in British Museum.

GENERAL CHARACTERS.—Similar to *agilis agilis* but generally smaller and with the ventral area self-colored, buffy white, and its center-most portion clear white.

DESCRIPTION.—Color above essentially the same dusty brown, near walnut brown, as in *agilis agilis*. Face scarcely paler than dorsum. Eye-ring more reduced than in *agilis*. Skull with zygomatic expansion rather slight; no trace of supraorbital ridges; molar toothrows shorter than in *agilis*.

MEASUREMENTS.—Taken in the flesh: length of head and body, 101 mm.; length of tail vertebræ, 126; length of hind foot (c.u.), 18; basal length of skull, 23.4; zygomatic breadth, 14.4; length of M^{1-3}, 4.5.

Chacoensis is based upon six specimens: four from Paraguay; one from Los Palmas in the Argentina Chaco; and one collected by Dr. Krieg (München), from Villa Montes, upper Rio Pilcomayo. The last-named animal has the underparts dull cinnamon-buff, and other slight color differences, and should perhaps be distinguished subspecifically.

Marmosa agilis buenavistæ, new subspecies

TYPE.—No. 26.12.4.91, British Museum; female, ad.; Buenavista, Department of Santa Cruz, Bolivia; March 7, 1916; collector, José Steinbach. The type is a skin and skull in fair condition; in British Museum.

General Characters.—A brownish form with rather coarser pelage than typical *agilis*, and further distinguished from *chacoensis* by its large ears and buff ventral color.

Description.—Color above near verona brown with face paler. Underparts yellow buff, self-colored except for the gray-based hiars which narrow the stomach area to a strip of self-colored hairs 10 mm. in width. Eye-ring well marked. Vibrissæ long; ear rather large; tail slightly bicolored, light fuscous brown.

Skull with rather broad zygomata; snout pionted, but rapidly broadening. Supraorbital ridges sharp. Palate as in *agilis* Bullæ well developed, rounded, with process as in *agilis*.

Measurements.—Taken from dried skin: length of head and body, 110 mm.; length of tail vertebræ, 140; length of hind foot (c.u.), 16; basal length of skull, 25.0; zygomatic breadth, 15.7; length of M^{1-3}, 4.6.

I have based this subspecies upon ten specimens, all of which have been collected in the neighborhood of Buenavista.

Marmosa agilis peruana, new subspecies

Type.—No. 27.11.1.268, British Museum; male, young ad.; Tingo Maria, Rio Huallaga, Peru, 2000 feet; January 20, 1927; collector, R. W. Hendee. The type is a skin and skull in good condition; in British Museum.

General Characters.—A subspecies of *agilis* with slightly grayer pelage which is "waved" much as in *marica*.

Description.—Above near Prout's brown with face paler. Underparts buff; self-colored as far backward as chest. Vibrissæ very short; ears very small. Glandular area of throat well developed. Feet buffy white; tail light, fuscous, slightly bicolored.

Skull with broadly spreading zygomata, narrow nasals with broadened bases; narrow muzzle; practically undeveloped supraorbital processes. Toothrows moderately convergent; teeth very small; bullæ small, rather compressed, with well-developed anterior processes.

Measurements.—Taken in the flesh: length of head and body, 91 mm.; length of tail vertebræ, 136; length of hind foot (c.u.), 16.5; basal length of skull, 23.2; zygomatic breadth, 15.0; length of M^{1-3}, 4.7.

The subspecies is based upon two specimens from Tingo Maria.

Marmosa unduaviensis, new species

Type.—No. 72563, Amer. Mus. Nat. Hist.; male, ad.; Pitiguaya, Rio Unduavi, Yungas, Bolivia, 5800 feet; May 12, 1926; collector, G. H. H. Tate. The type is a skin and skull, the latter in poor condition; in American Museum.

General Characters.—A fus ous-brownish form allied to *agilis*.

Description.—Dorsal color near mummy brown, darkest along middorsal line, paler on sides. Face scarcely paler. Eye-rings not well developed. Ventral color between cartridge buff and cream buff. Chin almost chamois. A narrow, intermittent, median-white line distinct only on lower chest. Pelage on throat showing specialized whorls of short stiff hairs. Ears small, fuscous brown. Vibrissæ very short, black. Feet very small, tail rather short.

Skull with characteristic form of *agilis*. Zygomata moderately broad; palate broad. Bullæ well rounded with a minute process.

MEASUREMENTS.—Taken in the flesh: length of head and body, 102 mm.; length of tail vertebræ, 120; length of hind foot (c.u.), 17; basal length of skull 26.5; zygomatic breadth, —; length of M^{1-3}, 5.0.

This form is based upon two specimens, the second of which is a young adult female.

Marmosa aceramarcæ, new species

TYPE.—No. 72568, Amer. Mus. Nat. Hist.; Rio Aceramarca, tributary of Rio Unduavi, Yungas, Bolivia, 10,800 feet; May 25, 1926; collector, G. H. H. Tate. The type is a skin and skull, the latter broken; in American Museum.

GENERAL CHARACTERS.—Strongly resembling the little *Marmosa dryas* from Mérida, Venezuela. Easily distinguishable from *unduaviensis* by its different color and very small teeth.

DESCRIPTION.—Color of back near Mars brown or russet, but containing fuscous shades that in certain lights make it look darker. Face not paler, the lower part touched with gray. Hairs of underparts except chin, which is buffy brown, with a light tawny over-wash, beneath which are gray bases. Fur very long and lax and filled with numerous over-hairs. Feet extremely small, whitish buff, the exterior part of the shank fuscous.

Skull with zygomata but little expanded; muzzle very narrow; palate narrow. Bullæ large, close together, with well-developed processes. Teeth extremely small, both ascending ramus and processus angularis extremely slender.

MEASUREMENTS.—Taken in the flesh: length of head and body, 83 mm.; length of tail vertebræ, 112; length of hind foot (c.u.), 16; basal length of skull, 23.6, zygomatic breadth, —; length of M^{1-3}, 4.7.

The species is known from the type only.

Marmosa lepida grandis, new subspecies

TYPE.—No. 26.12.4.94, British Museum; female, ad.; Buenavista, Santa Cruz, Bolivia; January 25, 1926; collector, José Steinbach. The type is a skin and skull in good condition; in British Museum.

GENERAL CHARACTERS.—Color as in true *lepida*, but size very much larger, with larger skull and teeth.

DESCRIPTION.—Dorsal color near Sanford's brown; ventral color pale cinnamon, the throat and chin alone having self-colored hairs. Pelage fine and soft and very long. Eye-rings reduced beneath. Ears very small, semitranslucent. Feet and claws very small. Inguinal region rusty vinaceous.

Skull a large copy of *lepida lepida* with similarly prolonged premaxillæ. Fine, pointed supraorbital processes. Bullæ rounded, without processes.

MEASUREMENTS.—Taken from dried skin: length of head and body, 120 mm.; length of tail vertebræ, 145; length of hind foot (c.u.), 19; basal length of skull, 26.2; zygomatic breadth, 17.2; length of M^{1-3}, 5.1.

This specimen, when captured, had five young. Except for one of the juveniles which is preserved, it is the only example known.

Marmosa juninensis, new species

Type.—No. 63864, Amer. Mus. Nat. Hist.; female, young ad.; Utcuyacu, between Tarma and Chanchamayo, Province of Junin, Peru, 4800 feet; November 25, 1929; collector, H. Watkins. The type is a skin and skull, the latter in poor condition; in American Museum.

General Characters.—Superficial appearance intermediate between *lepida* and *caucæ ucayaliensis*, but the cranial characters indicate its affinity with the former.

Description.—Color above near argus brown, beneath with the self-colored fascia posterior to the throat almost completely obscured by gray-based hairs. The gray basal portions of these hairs very neary approach their tip, giving underparts the grayish appearance suggestive of the silvery gray of *fuscata*. Inguinal hairs tawny.

Skull very small. Zygomata not wide-spreading; muzzle narrow. Bullæ moderate, the anterior processus well developed but short. Teeth very small, canines extremely short, compressed.

Measurements.—Taken from dried skin: length of head and body, 110 mm.; length of tail vertebræ, 133; length of hind foot (c.u.), 17.5; basal length of skull, —; zygomatic breadth, 14.4; length of M^{1-3}, 5.2.

Juninensis is represented by the type only.

Marmosa parvidens, new species

Type.—No. 18545, Field Mus. Nat. Hist.; female, young ad.; Hyde Park, thirty miles up Demarara River, British Guiana, twenty feet; September 8, 1906; collector, S. B. Warren. The type is a skin and skull in good condition; in Field Museum.

General Characters.—Distinguishable from the form of *lepida* occurring in Dutch Guiana by darker pelage, large ears, narrow zygomata, molariform canines and proportionately large $P\frac{1}{1}$.

Description.—Dorsal color near Hay's brown or natal brown, slightly paler at sides; face markedly paler. Eye-rings narrow. Underparts creamy buff, self-colored except slight narrowing at belly to 12 mm. Ears large; feet very small; tail brown.

Skull with narrow zygomata, the arches of which are extremely low at the position of the postorbital processes when seen from the sides. Supraorbital ridges unbeaded, represented by an angle only. No postorbital constriction. Palate rather narrow with accessory fenestræ. Bullæ moderately inflated with strong anterior processes. Teeth small, with unusual modification of $P\frac{1}{1}$ and $\frac{c}{c}$, the former unusually large, with anteroposterior length of P^1, 1.2 mm. The upper canine short, compressed, and provided with anterior and posterior cingular cusps.

Measurements.—Taken from dried skin: length of head and body, 105 mm.; length of tail vertebræ, 130; length of hind foot (c.u.), 15; basal length of skull, 25.0; zygomatic breadth, 14.9; length of M^{1-3}, 4.7.

This animal is shown to belong in the *microtarsus* group by its very small feet and claws, short vibrissæ and minute teeth. Previously it had been confused with *murina muscula*.

Marmosa elegans coquimbensis, new subspecies

TYPE.—No. 23302, Field Mus. Nat. Hist.; female, young ad.; Paiguano, Province of Coquimbo, Chile, 3300 feet; June 20, 1923; collector, C. C. Sanborn. The type is a skin and skull in good condition; in Field Museum.

GENERAL CHARACTERS.—A pale form of *elegans*.

DESCRIPTION.—Color of middle of dorsum near hair brown, lateral color near drab, but slightly paler and darker in patches, a pale brownish-drab median line from the frontal point of the dark dorsal area almost to the tip of muzzle. Remainder of face whitish drab. Both fore and hind limbs and underparts white, the underparts posterior to the neck very faintly tinged with yellowish. Gray-based hairs on hind limbs, as far distally as elbow of forelimbs and along each side of body from forelimb posteriorly. These gray-based hairs border a median self-colored area 17 mm. in width. Eye-ring even narrower than in typical *elegans,* its black color only about .5 mm. in width. The feet unusually small; but this may be an age character.

Skull closely similar to that of *elegans elegans* and measurements are within the range of young females of this subspecies. The bullæ, however, appear slightly larger and more approximated.

MEASUREMENTS.—Taken in the flesh: length of head and body, 92 mm.; length of tail vertebræ, 106; length of hind foot (c.u.), 14; basal length of skull, 24.3; zygomatic breadth, 14.6; length of M^{1-3}, 5.0.

This form, occurring some 200 miles north of Valparaiso, is apparently the arid-country representative of true *elegans*. Material examined: the type only.

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THE DISTRIBUTION OF ROTIFERA ON MOUNT DESERT ISLAND

By Frank J. Myers

The following list of Rotifera is based on collections made during the summer months of 1922 to 1931 inclusive.

Mount Desert Island is situated on the coast of Maine and is the largest of a group of many islands east of Penobscot Bay. The most conspicuous and dominant rock, and the one that makes up the greatest mass, is granite. The highland consists of a ridge of mountains trending nearly east and west, sloping gradually on the north and abruptly on the south side. They are the only mountains fronting the Atlantic coast of the United States. The ridge is divided into peaks by nine transverse, parallel valleys that have been cut out by erosion and glaciation. In these valleys are situated a series of beautiful mountain lakes, from the waters of which most of the species of Rotifera listed herein were collected.

On account of the geological formation of Mount Desert Island, the various bodies of permanent water are poor in mineral salts, especially calcium carbonate. Needham and Lloyd (1), mention that waters rich in calcium salts maintain, as a rule, a more abundant life than do other waters. As pointed out by Harring and Myers (2), bodies of alkaline (hard) water generally contain an immense number of individual rotifers represented by relatively few species, while permanent bodies of acid (soft) water contain relatively few individuals representing many species.

The hydrogen ion concentration of all bodies of permanent water examined was below 7.0, except in the middle of the larger lakes where it ascended to 7.4 . In the littoral region of these lakes, the hydrogen ion concentration varied between 6.4 and 6.8. In view of these facts, the rotatorian fauna of Mount Desert Island should be an acid fauna.

The impression that microscopic animals are essentially cosmopolitan and that their distribution is not a problem is no longer borne out by the facts, that is, so far as the Rotifera are concerned. The problem of distribution depends on the conditions of existence rather than on the means of distribution. That the rotifers enjoy a world-wide distribution, on account of the evident age of the group and the ease of transportation of the eggs of duration, is not to be gainsaid. That it is not possible to speak of any typical rotatorian fauna for any continent or zone, as was claimed by Rousselet (3), is not borne out by the results of recent investigations.

Only the order Ploima has been used here, for group index purposes, on account of the facility in collecting them, the more numerous habitats, and greater flexibility of the group as a whole.

The fresh-water ploimate rotifers may be roughly divided into three ecological groups.

Group 1. The Alkaline Fauna, containing all Rotifera tolerant of alkaline conditions and living in water having a p_H value of 7.0 and above.

Group 2. The Acid Fauna, containing all Rotifera tolerant of acid conditions and living in water having a p_H value of below 7.0.

Group 3. The Transcursion Fauna, containing all Rotifera that are tolerant of both alkaline and acid conditions.

While no sharp line of demarkation can be drawn between the acid fauna and the alkaline fauna, occasions where acid-water rotifers are found in slightly alkaline water and alkaline rotifers are found in slightly acid water are exceptions rather than the rule. So reliable is the distinction between these faunas that a glance at a collection from a given location will indicate its origin at once. Therefore, we can safely say that acid-water rotifers largely predominate in soft-water associations, and alkaline-water rotifers largely predominate in hard-water associations, with numerous transcursion rotifers in both associations.

In order to facilitate reference, locations yielding collections are numbered and the location number added after the record of each species, except where such species occurred in more than six locations, when it may be considered as being evenly distributed throughout the Island, and, in such cases the numbers after the records are omitted.

NAMES OF LOCATIONS

1.—The Barcelona, a meandering tide-plain stream on the north side of the Island. Average p_H value 6.0 to 6.4.

2.—Lake Wood, a small mountain lake on the north slope of the Island; elevation, 200 feet. Average p_H value 6.4 to 6.6.

3.—Lower Breakneck, a widespread of Duck Brook, formed by a beaver dam. Average p_H value 6.4 to 6.8.

4.—Eagle Lake, a mountain lake near the center of the Island; elevation, 275 feet. Average p_H value 6.6 to 7.2 in the middle.

5.—Somes Pond, a small lake formed by damming the outlet of Long Pond. Average p_H value 6.4.

6.—Pond Heath, sphagnum pools in marsh in the north side of the Island Average p_H value 6.2.

7.—Bubble Pond, a mountain lake in erosion valley, between Cadillac and Pemetic Mountains; elevation, 325 feet. Average p_H value 6.6.

8.—The Tarn, a widespread formed by damming Duck Brook; situated in erosion valley between Champlain and Flying Squadron Mountains. Average p_H value 6.6 to 6.8.

9.—Aunt Bettie Pond, a decadent body of water in low land; on the northern slope of the Island. Average p_H value 6.2.

10.—Long Lake, the largest body of fresh water on the Island; bounded by Beech Mountain on the east and Western Mountain on the west. The northern third of the lake lies on the low northern slope; elevation, 58 feet. Average p_H value 6.6; 6.8; 7.0 in the middle.

11.—Echo Lake, a glacial lake in erosion valley lying between Beech Hill and Acadia Mountain; elevation, 90 feet. Average p_H value 6.4.

12.—Witch Hole, a small pond on the northeastern part of the Island; it is rapidly disappearing by plant encroachment; elevation, 340 feet. Average p_H value 6.2 to 6.6.

13.—Salisbury Cove, on north shore of the Island, marine. Average p_H value above 8.0.

14.—Half Moon Pond, a small decadent pond in the hills of the northeastern part of the Island. Average p_H value 6.6 to 6.8.

15.—Duck Brook, a mountain stream running from Eagle Lake to its outlet in Frenchmans Bay. Average p_H value 6.4.

16.—Upper Hadlock Lake, a small lake lying in erosion valley, on southern slope of the Island between Penobscot and Norumberg Mountains. Average p_H value 6.6 to 6.8.

17.—Spring-fed pool on hill in the town of Salisbury Cove. Average p_H value?

18.—Faun Pond, a small body of water in hills, on northeastern slope of the Island. Average p_H value 6.2 to 6.6.

19.—The Bowl, a pond near the top of a six-hundred foot elevation known as The Beehive, situated on the eastern shore of the Island. Average p_H value?

20.—Round Pond, a pond on the flats of the northern slope; emptying into Long Lake by a short connection. (Sometimes called Dark Pond.) Average p_H value 6.4.

21.—Northeastern arm of Long Lake, a shallow bay. Average p_H value 6.6.

22.—Ripple Pond, a widespread of stream connecting Long Lake with Somes Pond; formed by the site of an ancient dam. Average p_H value 6.4.

23.—Northeast Branch, a meandering tide-level stream emptying into Thomas Bay, on northern shore. Average p_H values 6.0 to salt water above 8.0.

24.—Toad Hole, a small round bay at the outlet of Long Lake. Average p_H value 6.6. to 6.8.

25.—Jordan Pond, a mountain lake, in erosion valley, between Pemetic and Jordan Mountains. Average p_H value 6.6.

26.—Ice Ponds, old artificial ponds near town of Manset. Average p_H value 6.2 to 6.8.

27.—Jordan Mountain Pond, a small body of water between summits of Penobscot and Sargent Mountains; elevation about 1000 feet. Average p_H value 6.4.

28.—Pond in town of Mount Desert. Average p_H value 6.6.
29.—Pond in marsh behind sea wall, on southern shore. Average p_H value 7.8.
30.—Frenchmans Bay, marine.

FAUNAL LIST

The following is a list of described species only. There are numerous species, new to science, to be described in later publications.

Abbreviations: *Ac.* = acid; *Ak.* = alkaline; *Tr.* = transcursion.

Group abbreviations are omitted in cases where the individuals do not belong to the order Ploima.

Adineta gracilis Janson.
Adineta vaga (Davis).
Albertia intrusor Gosse, 4, *Tr.*
Ascomorpha eucadis Perty, *Tr.*
Ascomorpha hyalina (Kellicott), 12, *Tr.*
Ascomorpha saltans Bartsch, *Tr.*
Ascomorpha volvocicola (Plate), 12, 21, *Ak.*
Aspelta aper (Harring), *Tr.*
Aspelta beltista Harring and Myers, *Ac.*
Aspelta circinator (Gosse), *Tr.*
Aspelta cyldona Harring and Myers, marine.
Aspelta labri Harring and Myers, 10, *Ac.*
Aspelta macra Harring and Myers, 12, *Ac.*
Asplanchna herrickii de Guerne, 2, 12, *Tr.*
Asplanchna priodonta Gosse, 4, 10, 20, *Ak.*
Asplanchnopus hyalinus Harring, 7, 8, *Tr.*
Asplanchnopus multiceps (Schrank), 8, 15, *Ak.*
Beauchampia crucigera (Doutrochet), 12, 18.
Birgea enantia Harring and Myers, *Ac.*
Brachionus capsuliflorus Pallas, 8, *Ak.*
Brachionus patulus Müller, 9, *Ak.*
Brachionus plicatilis Muller, 9, *Ak.*
Brachionus polycanthus Ehrenberg, 1, 24, *Tr.*
Cephalodella apocolea Myers, *Ac.*
Cephalodella auriculata (Müller), *Tr.*
Cephalodella collactea Myers, 12, *Ac.*
Cephalodella compressa Myers, 12, 24, *Ac.*
Cephalodella crassipes (Lord), 15, *Ak.*
Cephalodella cuneata Myers, 23, *Ac.*
Cephalodella elegans Myers, 1, 12, *Ac.*
Cephalodella elongata Myers, *Ac.*
Cephalodella eva (Gosse), *Tr.*
Cephalodella exigua (Gosse), *Tr.*
Cephalodella forficata (Ehrenberg), *Tr.*
Cephalodella forficula (Ehrenberg), *Tr.*
Cephalodella galbina Myers, 23, *Ac.*

Cephalodella gibba (Ehrenberg), *Tr.*
Cephalodella gracilis (Ehrenberg), *Tr.*
Cephalodella hiulka Myers, 12, *Ac.*
Cephalodella hoodii (Gosse), 1, *Ak.*
Cephalodella hyalina Myers, 8, 12, *Ac.*
Cephalodella innesi Myers, 3, 4, *Ac.*
Cephalodella inquillina Myers, *Ac.*
Cephalodella intuta Myers, 1, 12, 24, *Ac.*
Cephalodella magalocephalia (Glasscott), *Tr.*
Cephalodella mucronata Myers, 9, 12, 14, 20, *Ac.*
Cephalodella nana Myers, 2, 24, *Ac.*
Cephalodella nelitis Myers, 12, 23, *Ac.*
Cephalodella physalis Myers, 1, 12, 20, *Ac.*
Cephalodella plicata Myers, 12, 14, 24, *Ac.*
Cephalodella sterea (Gosse), 1, *Ak.*
Cephalodella stirgosa Myers, 7, 12, *Ac.*
Cephalodella strepta Myers, 12, 15, *Ac.*
Cephalodella tantilla Myers, *Tr.*
Cephalodella tenuior (Gosse), *Tr.*
Cephalodella ventripes (Dixon-Nuttall), 1, 4, *Ak.*
Chromogaster ovalis (Bergendal), *Tr.*
Collotheca ambigua (Hudson), 21.
Collotheca atrochoides (Wierzjeski), 12.
Collotheca campanulata (Dobie).
Collotheca conklini (Montgomery), 4.
Collotheca cornuta (Dobie).
Collotheca edentata (Collins), 6.
Collotheca heptabrachiata (Schock), 3.
Collotheca hoodii (Hudson), 12.
Collotheca mutabilis (Hudson), 12, 20, 25.
Collotheca tenuilobata (Anderson), 18.
Collotheca triolobata (Collins), 25, 27.
Colurella adriatica Ehrenberg, 24, *Tr.*
Colurella ambleytela (Gosse), 13, marine.
Colurella bicuspidata (Ehrenberg), *Tr.*
Colurella obtusa (Gosse), *Tr.*
Colurella sulcata (Stenroos), 18, *Tr.*
Colurella tesselata (Glasscott), 2, 18, *Tr.*
Conochilus hippocrepis (Schrank), *Tr.*
Conochilus unicornis Rousselet, 4, 23, 25, *Ak.*
Conochiloides dossuarius (Hudson), 29, *Ak.*
Conochiloides natans (Seligo), 12, *Ak.*
Cupelopagis vorax (Leidy), 12, 23, 25, *Tr.*
Cyrtonia tuba (Ehrenberg), 12, 24, *Tr.*
Dapidia calpidia Myers, *Ac.*
Dicranophorus alcimus Harring and Myers, *Ac.*
Dicranophorus artamus Harring and Myers, *Ac.*
Dicranophorus aspondus Harring and Myers, 2, *Ac.*

Dicranophorus biastis Harring and Myers, 12, *Ac.*
Dicranophorus capucinus Harring and Myers, *Ac.*
Dicranophorus colastes Harring and Myers, *Ac.*
Dicranophorus corystis Harring and Myers, *Tr.*
Dicranophorus edestes Harring and Myers, 1, 10, *Tr.*
Dicranophorus epicharis Harring and Myers, 12, 20, *Tr.*
Dicranophorus forcipatus (Müller), 1, *Ak.*
Dicranophorus grippus Harring and Myers, 12, 21, *Ac.*
Dircanophorus isothes Harring and Myers, *Ac.*
Dicranophorus lütkeni (Bergendal), *Tr.*
Dicranophorus pennatus Harring and Myers, 24, *Ac.*
Dicranophorus ponerus Harring and Myers, 3, *Tr.*
Dicranophorus proclastes Harring and Myers, *Ac.*
Dicranophorus robustus Harring and Myers, *Tr.*
Dicranophorus semnus Harring and Myers, 3, *Ac.*
Dicranophorus tegillus Harring and Myers, *Ac.*
Dicranophorus uncinatus (Milne), 2, *Ac.*
Dipleuchlanis propatula (Gosse), 2, 3, *Ak.*
Dissotrocha aculeata (Ehrenberg).
Dissotrocha macrostyla (Ehrenberg).
Diurella brachyura (Gosse), *Tr.*
Diurella cavia (Gosse), *Tr.*
Diurella collaris (Rousselet), *Tr.*
Diurella insignis Herrick, *Tr.*
Diurella porcellus (Gosse), *Tr.*
Diurella rousseleti (Voight), 12, *Tr.*
Diurella stylata Eyferth, *Tr.*
Diurella sulcata (Jennings), 1, 8, 19, *Tr.*
Diurella tigris (Muller), *Tr.*
Diurella weberi Jennings, 12, 24, *Ak.*
Dorystoma caudata (Bilfinger), 1, 12, *Tr.*
Embata laticeps (Murray).
Embata laticornis (Murray).
Encentrum eristes Harring and Myers, 13, marine.
Encentrum felis (Müller), *Tr.*
Encentrum lacidum Harring and Myers, 13, marine.
Encentrum marinum (Dujardin), 13, marine.
Encentrum nesites Harring and Myers, 13, marine.
Encentrum otois Harring and Myers, 20, *Ac.*
Encentrum ricciæ Harring, 1, 18, 25, *Tr.*
Encentrum zetetum Harring and Myers, 15, *Ac.*
Eothina argus Harring and Myers, 12, *Ac.*
Eothina elongata (Ehrenberg), *Tr.*
Erignatha belodon Harring and Myers, 3, 9, *Ac.*
Erignatha capula Harring and Myers, 3, *Ac.*
Erignatha clastopis (Gosse), *Tr.*
Erignatha tryphæa Harring and Myers, *Ac.*
Euchlanis alata Voronkov, *Tr.*

Euchlanis callysta Myers, 1, 10, 12, *Ac.*
Euchlanis dilatata Ehrenberg, *Tr.*
Euchlanis meneta Myers, *Tr.*
Euchlanis parva Rousselet, *Tr.*
Euchlanis pellucida Harring, *Ac.*
Euchlanis phryne Myers, 24, *Ac.*
Euchlanis triquetra Ehrenberg, *Tr.*
Filina longiseta (Ehrenberg), 4, *Ak.*
Floscularia conifera (Hudson).
Floscularia janus (Hudson).
Floscularia melicerta (Ehrenberg), 12.
Floscularia ringens (Linnæus).
Gastropus minor (Rousselet), *Tr.*
Gastropus orbicularis (Kellicott), 12, *Ak.*
Gastropus stylifer Imhof, 12, 26, *Ak.*
Habrothrocha angusticollis (Murray).
Habrotrocha collaris (Ehrenberg).
Habrotrocha constricta (Dujardin).
Habrotrocha eremita (Bryce).
Habrotrocha lata (Bryce).
Habrotrocha munda (Bryce).
Harringia rousseleti de Beauchamp, *Tr.*
Itura aurita (Ehrenberg), 12, *Ak.*
Keratella paludosa (Lucks), 8, *Ak.*
Keratella quadrata (Müller), *Tr.*
Keratella serrulata (Ehrenberg), *Tr.*
Lecane acronycha Harring and Myers, *Ac.*
Lecane agilis (Bryce), 14, 20, *Tr.*
Lecane aquila Harring and Myers, 12, *Ac.*
Lecane arcula Harring, 12, *Tr.*
Lecane brachydactyla (Stenroos), *Ac.*
Lecane clara (Bryce), *Tr.*
Lecane crepida Harring, 24, *Tr.*
Lecane depressa (Bryce), 12, *Tr.*
Lecane flexilis (Gosse), *Tr.*
Lecane grandis (Murray), 13, 30, marine.
Lecane haliclysta Harring and Myers, 12, *Ac.*
Lecane intrasinuata (Olofsson), *Ac.*
Lecane jessupi Harring, *Ac.*
Lecane lauterborni Hauer, 8, 12, 20, *Ac.*
Lecane leontina (Turner), *Tr.*
Lecane ligona (Dunlop), 12, 15, *Ac.*
Lecane ludwigii (Eckstein), *Ak.*
Lecane luna (Müller), *Tr.*
Lecane mira (Murray), *Ac.*
Lecane nana (Murray), 12, *Tr.*
Lecane noithis Harring and Myers, 26, *Ac.*
Lecane ohioensis (Herrick), 8, 12, *Ak.*

Lecane pelatis Harring and Myers, 12, 18, *Ac.*
Lecane pertica Harring and Myers, 12, *Ac.*
Lecane ploenensis (Voight), 3, *Tr.*
Lecane pycina Harring and Myers, 7, *Ac.*
Lecane pyrrha Harring and Myers, 2, *Ac.*
Lecane rhacois Harring and Myers, *Tr.*
Lecane rhytida Harring and Myers, 9, *Ac.*
Lecane saginata Harring and Myers, 3, 12, *Ac.*
Lecane sagula Harring and Myers, 12, *Tr.*
Lecane satyrus Harring and Myers, *Ac.*
Lecane signifera (Jennings), 12, 25, *Tr.*
Lecane stichæa Harring, *Tr.*
Lecane stokesii (Pell), 1, 12, 20, *Ak.*
Lecane tabida Harring and Myers, 8, *Tr.*
Lecane tenuiseta Harring, *Tr.*
Lecane tryphema Harring and Myers, 9, *Ac.*
Lecane ungulata (Gosse), *Tr.*
Lepadella acuminata (Ehrenberg), 1, 12, *Tr.*
Lepadella benjamini Harring, 2, *Ak.*
Lepadella cristata (Rousselet), *Tr.*
Lepadella latusinus (Hilgendorf), 1, *Tr.*
Lepadella ovalis (Müller), *Tr.*
Lepadella patella (Müller), *Tr.*
Lepadella quinquecostata (Lucks), *Tr.*
Lepadella rhomboides (Gosse), 4, 8, *Ak.*
Lepadella rhomboidula (Bryce), 12, *Ac.*
Lepadella triptera Ehrenberg, *Tr.*
Limnias ceratophylli Schrank.
Limnias myriophylli (Tatem).
Lindia annecta Harring and Myers, 4, *Ac.*
Lindia fulva Harring and Myers, *Ac.*
Lindia pallida Harring and Myers, *Tr.*
Lindia truncata (Jennings) 12, 20, *Tr.*
Macrochaetus collinsii (Gosse), *Tr.*
Macrochaetus subquadtatus Perty, 12, *Tr.*
Macrotrachela crucicornis (Murray).
Macrotrachela cuthberti Milne.
Macrotrachela ehrenbergi (Janson).
Macrotrachela habita (Bryce).
Macrotrachela multispinosa zickendrahti (Richters).
Macrotrachela musculosa Milne.
Macrotrachela nana (Bryce).
Macrotrachela plicata (Bryce).
Macrotrachela quadracornifera Milne.
Microcodon clavus Ehrenberg, *Tr.*
Mikrocodides chlæna (Gosse), 1, 3, 4, *Tr.*
Mniobia symbiotica (Zelinka).
Monommata appendiculata Stenroos, *Ac.*

Monommata astia Myers, 12, 20, *Tr.*
Monommata caudata Myers, 9, *Ac.*
Monommata cæca Myers, 19, *Ac.*
Monommata diaphora Myers, 19, *Ac.*
Monommata enedra Myers, 9, 12, *Ac.*
Monommata grandis Tessin, *Tr.*
Monommata hyalina Myers, 12, 20, *Ac.*
Monommata longiseta (Muller), *Tr.*
Monommata maculata (Harring and Myers), *Tr.*
Monostyla acus Harring, 2, *Ak.*
Monostyla bifurca Bryce, 3, 20, *Tr.*
Monostyla bulla Gosse, *Tr.*
Monostyla closterocerca Schmarda, *Tr.*
Monostyla crenata Harring, *Tr.*
Monostyla elachis Harring and Myers, *Tr.*
Monostyla furcata Murray, 3, *Tr.*
Monostyla hamata Stokes, *Tr.*
Monostyla lunaris (Ehrenberg), *Tr.*
Monostyla monostyla (Daday), 12, *Ak.*
Monostyla pygmæa Daday, *Tr.*
Monostyla quadradentata Ehrenberg, *Ak.*
Monostyla rhopalura Harring and Myers, *Tr.*
Monostyla styrax Harring and Myers, *Tr.*
Monostyla tethis Harring and Myers, 9, *Ac.*
Monostyla vastita Harring and Myers, 20, *Ac.*
Mytilina ventralis Ehrenberg, 2, 28, *Ak.*
Notholca bostoniensis Rousselet, 12, 14, *Tr.*
Notholca longispina (Kellicott), 21, *Ak.*
Notholca striata (Müller), 23, *Ak.*
Notommata cerberus (Gosse), *Tr.*
Notommata codonella Harring and Myers, 14, 20, *Ac.*
Notommata contorta (Stokes), *Tr.*
Notommata copeus Ehrenberg, *Tr.*
Notommata cyrtopus Gosse, *Tr.*
Notommata doneta Harring and Myers, 3, 12, 24, *Ac.*
Notommata falcinella Harring and Myers, 7, 8, *Ak.*
Notommata lenis Harring, 1, 12, *Tr.*
Notommata pachyura (Gosse), *Tr.*
Notommata pachuyra triangularis (Kirkman), 12, *Tr.*
Notommata peridia Harring and Myers, *Ac.*
Notommata pseudocerberus de Beauchamp, *Tr.*
Notommata pygmæa Harring and Myers, 10, 12, *Ac.*
Notommata telmate Harring and Myers, 4, 8, 21, *Ac.*
Notommata tithasa Harring and Myers, 1, 12, *Ac.*
Notommata thopica Harring and Myers, *Ac.*
Notommata saccigera Ehrenberg, *Ac.*
Notommata silpha (Gosse), 3, 12, 24, *Tr.*
Octotrocha speciosa Thorpe.

Philodina acuticornis Murray.
Philodina citrina Ehrenberg.
Philodina megalotrocha Ehrenberg.
Philodina plena (Bryce).
Platyias quadracornis (Ehrenberg), 1, *Ak.*
Pleurotrocha petromyzon Ehrenberg, *Tr.*
Pleurotrocha robusta (Glasscott), *Ac.*
Plœsoma lenticulare (Herrick), *Tr.*
Plœsoma triacanthum (Bergendal), 4, 8, *Tr.*
Plœsoma truncatum (Levander), 2, 12, *Tr.*
Polyarthra euryptera Wierzeski, 2, *Tr.*
Polyarthra trigla Ehrenberg, *Tr.*
Proales brevipes Harring and Myers, 3, *Tr.*
Proales decipiens (Ehrenberg), *Tr.*
Proales doliaris (Rousselet), 12, 20, 24, 26, *Ac.*
Proales neapolitana (Daday), 13, marine.
Proales parasita (Ehrenberg), 21, *Ak.*
Proales reinhardti (Ehrenberg), 13, marine.
Proales similis de Beauchamp, 13, marine.
Proales sordida Gosse, *Tr.*
Proalinopsis caudatus (Collins), *Tr.*
Proalinopsis staurus Harring and Myers, 1, 12, *Ac.*
Pseudoecistes rotifer Stenroos, *Tr.*
Resticula anceps Harring and Myers, 24, *Ac.*
Resticula melandocus (Gosse), *Tr.*
Resticula nyssa Harring and Myers, 12, *Ac.*
Rotaria elongata (Weber).
Rotaria macroceros (Gosse).
Rotaria macrura Ehrenberg.
Rotaria mento (Anderson).
Rotaria ovata (Anderson).
Rotaria rotatoria (Pallas).
Rotaria sordida (Western).
Rotaria spicata (Murray).
Rotaria tardigrada (Ehrenberg).
Rousseletia corniculata Harring, *Tr.*
Scaridium eudactylotum Gosse, 22, *Ak.*
Scaridium longicaudum (Müller), *Tr.*
Squatinella leydigii (Zachrias), 12, 24, *Ac.*
Squatinella longispinata (Tatem), *Tr.*
Squatinella mutica (Ehrenberg), *Tr.*
Squatinella tenella (Byrce), 12, 24, *Tr.*
Squatinella tridentata (Fresenius), *Tr.*
Stephanoceros fimbriatus (Goldfuss).
Streptognatha lepta Harring and Myers, 12, 22, 20, 24, *Ac.*
Synchæta baltica Ehrenberg, 13, marine.
Synchæta johanseni Harring, 30, marine.
Synchæta oblonga Ehrenberg, 4, 6, 12, *Tr.*

Synchæta pectinata Ehrenberg, *Tr.*
Synchæta stylata Wierzejski, 4, 6, *Ak.*
Synchæta tremula (Müller), 12, *Tr.*
Taprocampa annulosa Gosse, *Tr.*
Taprocampa selenura Gosse, 8, 12, *Tr.*
Testudinella incisa (Ternetz), *Tr.*
Testudinella parva (Ternetz), *Tr.*
Testudinella parva bidentata (Ternetz), *Tr.*
Testudinella patina (Hermann), 10, 29, *Ak.*
Tetrasiphon hydrocora Ehrenberg, 3, 9, 12, *Ac.*
Trichocerca bicristata (Gosse), *Tr.*
Trichocerca bicuspes (Pell), 12, 28, *Ak.*
Trichocerca capucina (Wierzejski and Zachrias), 12, 28, *Ak.*
Trichocerca carinata (Ehrenberg), 1, 12, *Ak.*
Trichocerca curvata (Levander), 30, marine.
Trichocerca cylindrica (Imhof), 1, 12, *Ak.*
Trichocerca elongata (Gosse), 8, *Tr.*
Trichocerca flava (Voronkov), 1, 12, 19, 24, *Tr.*
Trichocerca iernis (Gosse), 2, 12, *Tr.*
Trichocerca lata (Jennings), *Tr.*
Trichocerca longiseta (Schrank), *Tr.*
Trichocerca marina (Daday), 13, marine.
Trichocerca mucosa (Stokes), 4, *Tr.*
Trichocerca multicrinis (Kellicott), 8, 21, 26, *Ak.*
Trichocerca pusilla (Jennings), 6, 7, 20, 24, *Tr.*
Trichocerca scipio (Gosse), *Tr.*
Trichotria similis (Stenroos), *Tr.*
Trichotria tatractis (Ehrenberg), *Tr.*
Tylotrocha monopus (Jennings), *Tr.*

Rotifers of the orders Flosculariacea, Collothecacea, and Bdelloida were not especially searched for. Individuals were recorded, however, when observed, in order to make the faunal list as complete as possible. Counting the species of the above orders, and also the undescribed species considered to be valid, we have a total of four hundred and forty-nine. This is a large number for an island of only one hundred and five miles in area.

Collections made over a period of time in the lakes of the Yahara basin, Wisconsin, gave forty-seven alkaline Ploima and ninety-one transcursion species; the acid-water rotifers were missing, not one individual being recorded.

Such typical alkaline-water genera, as *Asplanchna*, *Brachionus*, *Filina*, *Mytilina*, *Lacinularia*, and *Sinantherina* were nearly or entirely absent in the Mount Desert collections, while they were abundant in the collections from the lakes of the Yahara basin.

The faunal list from Mount Desert Island agrees with those of Atlantic County and the Pine Barrens, New Jersey, expanses composed of deep silicious deposit surrounded by alkaline areas. It also agrees with that of Vilias County, Wisconsin, a large area composed of deep glacial drift.

In view of these facts, the rotifer fauna of Mount Desert Island may be considered as an acid fauna, correlated to the hydrogen ion concentration of the various bodies of water as indicated by their p_H values.

LITERATURE CITED

(1) NEEDHAM, J. G., and LLOYD, J. T. 1916. 'Life of Inland Waters.' Ithaca, 438 pages, text figs.

(2) HARRING and MYERS, F. J. 1928. 'The Rotifer Fauna of Wisconsin.' Trans. Wis. Acad. Sci. Arts and Letters, XIV, pp. 667–808, Pls. XXIII–XLIX.

(3) ROUSSELET, C. F. 1910. 'On the Geographical Distribution of the Rotifera.' Rep. British Assoc. Adv. Aci. (for 1909), pp. 508–510.

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A NEW GIANT WAX SCALE FROM HAITI

By Herbert L. Dozier

The species of coccid described here is one of the largest and most interesting members of the widely distributed genus *Ceroplastes.* It appears to be fairly common in Haiti at certain seasons. Professor T. D. A. Cockerell, who kindly checked on the validity of the species, states that he observed a somewhat similar *Ceroplastes* in the Congo Museum in Belgium and that our species might possibly be of African origin.

Fig. 1.—Branches of *Ficus rubricosta* infested with *Ceroplastes giganteus* Dozier, about natural size

Ceroplastes giganteus, new species

The species is nearest in size to *Ceroplastes gigas* Cockerell from the Philippines, which measures 17.5 mm., and to *C. vuilleti* Marchal from Senegal, which measures 22 mm. in length, but is totally different in form and coloration. It resembles more closely *C. depressus* Cockerell, described from Jamaica on lignum-vitæ. It is very much smaller, but the pattern of the dorsal wax plates is different.

C. giganteus is a typical *Ceroplastes.* The general appearance of the adult female scale is rather flat, completely covered with a mass of wax, divided into seven distinct wax plates and a central area somewhat depressed, the lateral plates on each side with a streak of white secretion. Measures 14 mm. in length, 11 mm. in width, and from 2 to 3 mm. in height. Its color is a creamy wax with a faint olive or greenish tinge. Old females, after egg deposition, and other old ones, after death, shrink in length to about 12 mm. and become swollen, roundingly elevated, and the segmentation or plates less pronounced.

When boiled in caustic potash solution it renders the liquid a dark violet-black color. The denuded female measures 8.75 mm. in length and 7.50 mm. in width. Its most striking feature is the distinct mesal slit or caudal cleft with the caudal plates large, thick, and opaque. The derm, after boiling, becomes more or less transparent. There are four distinct lateral stigmatic depressions, the bullet-shaped spines numbering about sixty. The antennæ are six-jointed.

Described from eight boiled females mounted on slides in balsam and abundant fresh material collected by the writer on branches of a "Figuier," *Ficus rubricosta* Warb., at Source Cazeau, Haiti, December 3, 1930. On that date the older stages were very abundant. Previously, the adult females, younger stages, and males' cases had been noted as fairly abundant on the same trees on April 14, 1930. These scales are usually found on the higher branches of the tree.

The type is in The American Museum of Natural History, New York City. Material of the same species, collected by Dr. G. N. Wolcott, on the upper branches of a large "Mapou blanc" (*Neobuchia paulinæ* Urban) tree, fifteen miles south of St. Marc, Haiti, January 28, 1927, is in the collection of the Service Technique.

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ROCKY MOUNTAIN BEES. IV[1]

By Hugo G. Rodeck

THE GENUS *NOMADA*

The bees of the parasitic genus *Nomada* discussed in the following pages all belong to the collection of The American Museum of Natural History, and the types of new species described herein are deposited in that institution. I should like to express my gratitude to the American Museum for the privilege of studying this collection, and more especially to Professor T. D. A. Cockerell, of the University of Colorado, without whose kindly encouragement and assistance this study would never have been begun.

NOMADA

GNATHIAS Robertson

With bidentate mandibles.

MALES

1.—Abdomen with entire or narrowly interrupted yellow or cream-colored bands, usually at least on tergites 2 and 3, sometimes (*leucozona*) on 2 only; slightly larger. . . . . .2.

Abdomen dark red without bands, but usually with spots at lateral margins of tergites 2, 3, and 4, the last sometimes small and obscure; small.
lepida cuneata (Robertson).

2.—Second abdominal tergite with an ivory-white, continuous band, narrowed medially; first tergite with two inconspicuous white lateral spots, third with two white lateral marks pointed mesad, very close to posterior margin of second tergite; 9 mm. *leucozona*, new species.

Mesothorax black; slightly interrupted yellow or yellowish bands on tergites 2 and 3, frequently also on 1, and on 4–6. Size variable . . .*lepida* Cresson.

FEMALES

1.—Abdomen without yellow markings but with narrow black bands at base of tergites 2–4 and a W-shaped mark at base of first segment. Face with a large black area involving ocelli, front, and antennal fossæ, and extending downward on either side of clypeus, leaving only lateral face-marks, clypeus, and a small isolated supraclypeal spot red. 8 mm. . . . .*orophila* Cockerell, variety.

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[1] Nos. I to III of this series appeared in American Museum Novitates Nos. 433, 458, and 490, respectively.

Abdomen with light lateral spots at least on second segment. Black on face around antennæ always separated from that around ocelli by red........2.

2.—No black whatever around antennal insertions. The only black on the head is a small patch between the ocelli, and at extreme posterior of the head capsule. Only a tiny black spot on propodeum, and none whatever at base of abdomen, dorsally or ventrally. A brilliant sublateral yellow spot on either side of segment 2. Joints 3 and 4 of antennæ subequal. Third cubital cell as broad above as second. Robust. 7+ mm......*carolinæ* Cockerell, variety.

At least a little black around antennal insertions and at base of first abdominal segment... .....3.

3.—Second cubital cell very broad above, practically square. Third about as broad below as the second is above, but narrowed at the top almost to a point. Lateral spot on second abdominal segment bright cream-colored. Ocelli transparent, colorless, prominent, 8 mm....*heterosticta* Cockerell, variety.

Second cubital narrowed above more or less, the third not nearly produced to a point above. Lateral spot on second abdominal segment yellow........4.

4.—Light spots on second abdominal segment only. Basal nervure basad of nervulus a distance less than the length of the latter. Third cubital about as wide above as the second. Head and thorax with considerable black. 9.5 mm. *lepida* Cresson.

Small light spots on third abdominal segment as well as on second. Basal nervure far basad of nervulus. Third cubital cell about half as wide above as the second. Less black on head and thorax. 7 mm...*lepida cuneata* (Robertson).

Nomada (Gnathias) lepida Cresson

COLORADO.—Boulder, April 26 and April 28, 1913, two males (Ellis). Plainview to Eldorado Springs, May 22, 1921, one female (Jackson).

One of the males is typical *lepida* as described by Cresson. The other is larger and possibly comes nearer to *bella*, but I leave it here for the present.

The female is undoubtedly *lepida*, showing the peculiar markings at each side of the base of the first abdominal segment which seem to be a rather constant character in the females of this species.

Nomada (Gnathias) lepida cuneata (Robertson)

COLORADO.—Boulder, June 6, 1922, 24 males, one female (F. E. Lutz).

In view of the observations of Cockerell and Swenk on the identity of *lepida* Cresson and *cuneata* Robertson, I refer these specimens here. They are, however, so different from the typical *lepida* that I have seen from this district that I feel compelled to employ the trinomial to perpetuate in the literature records which may be of importance in the future study of this variable, if not composite, group. Until more is known of the host relations and general biology of the genus *Nomada*, excessive lumping of forms will serve only to obscure biological facts which may prove to be of great importance.

The only female specimen is lacking both flagella and the right anterior wing. The males are variable, from 6 to 8 mm. in length. In abdominal markings they vary from 8-spotted to 4-spotted. The scutellar lobes vary from confluently red to red-spotted to black, and the scape is yellow in front in some, ferruginous in others, and in one is entirely black.

Nomada (Gnathias) carolinæ Cockerell variety

WYOMING.—Jackson, July 13–17, 1920, alt. about 6600 ft. (F. E. Lutz).

This specimen has no black whatever on the face around the antennæ and likewise none whatever at the base of the abdomen, dorsally or ventrally. The propodeum has only a tiny spot of black at the posterior point of the enclosed area medially. The only dark marks on the legs are on the bases of the coxæ behind. The date of collection, however, would seem to be rather late for *carolinæ*. A specimen from Texas is mentioned by Swenk as being taken on March 20, 1907, and a male from Virginia on May 9 (1907?). According to the same author, the species flies in Nebraska from April 13 to May 17, and one was taken in North Dakota on May 8, 1912. (The type, from North Carolina, was apparently not dated.) It is reasonable to believe that perhaps the later season at Jackson (43° 30′ N., 110° 16′ W., altitude 6600 feet) might cause its appearance there in July.

Nomada (Gnathias) heterosticta Cockerell variety

IDAHO.—Victor, July 11, 1920, alt. about 6300 ft., one female (Mrs. F. E. Lutz).

Lacks the "small black spot at each side of third segment near base," the area between the antennæ is definitely black, the femora have considerable black basally, there is black at base of abdomen above and below. The black at base of venter of the first abdominal segment is "like a fish tail, with sharp points," as is given by Cockerell for his *perplexa* variety from Wyoming, but the venation is considerably different from a Virginia specimen of male *perplexa*, the color is much lighter, the face is slightly wider, the antennal proportions are not similar, the ocelli (if they are of any value in separating species) are lighter in color, the eyes (in the dried specimen) are purple instead of fuscous, etc. In view of the very distinctive venation I think it best to leave it as a variety of *heterosticta*, separable on the basis of the characters listed above, especially since it is one of the same lot of insects as the type of *heterosticta*, taken at the same locality and at the same time.

Nomada (Gnathias) orophila Cockerell variety

WYOMING.—Stewart Ranger Station, near Jackson, July 18, 1920, alt. about 6700 ft., one female (Mrs. F. E. Lutz).

Differs from true *orophila* female (as described) in having extremely scanty hair on head and thorax, that on thorax and scutellum not "strongly reddish"; face with yellowish suffusions at lower corners; the black bands passing downward from each antenna joined over the supraclypeal area, except for an obscure red spot above the clypeus; eyes slightly plum-colored; first joint of flagellum (second antennal joint) dark basally; mesothorax with the median black band but without the lateral ones; hind femora with a black stripe behind extending nearly to the apex; abdomen with no yellow spots whatever; basitarsi strongly dusky. Other striking characters not specifically mentioned in the original description of the female, but which are found on the present specimen, are: narrow black bands at bases of abdominal tergites 2, 3, and 4, as in the male; heavy black W-shaped mark at base of first abdominal segment.

I have not seen a specimen of female *orophila* but after comparison with the male I place this specimen here without much hesitation. The types of *orophila* were taken June 20, 1920, while the present insect was found a month later, on July 18, 1920.

Nomada (Gnathias) leucozona, new species

COLORADO.—Boulder, April 14, 1931, at *Salix* (Pauline Lundy).

MALE.—Head and thorax dark, with grayish-white pubescence; abdomen red with one white band.

Length, 9 mm. Head and thorax mahogany-red with much black, closely and rather coarsely punctured. Ivory-white markings as follows: mandibles except tips; labrum; clypeus except narrowly above; lateral face-marks ending in a suffused point about half-way up anterior orbits; beneath eyes narrowly and a narrow suffused stripe up posterior orbits; a small spot (somewhat suffused reddish) at summit of each eye; an inconspicuous transverse mark on collar; and a suggestion of light spots on summits of scutellar lobes. Black as follows: about antennæ with a line downward from each insertion to lateral clypeal margins; front; ocellar region; occiput; most of prothorax except dorsally; a median stripe on mesothorax and two narrow lateral stripes failing posteriorly; pleuræ immediately beneath wings and a broad stripe from wings to middle and hind coxæ; all of metathorax except two lateral red spots not entering enclosure. Tubercles orange. Thick grayish-white pubescence on head and thorax. Mandibles bidentate, apical third black. Scutellum prominent, moderately bilobed. Antennæ dark ferruginous; scape somewhat blackened behind; flagellum dark behind, especially basally; apical joint somewhat pointed; third antennal joint a little shorter than fourth. Tegulæ orange, punctured but shining. Basal nervure far basad of nervulus; second cubital cell not narrowed greatly above and receiving the first recurrent about at middle of base; third cubital greatly narrowed above, its outer margin strongly bent; receives second recurrent at about two-thirds of the distance along the base; wings iridescent, clear, strongly clouded at extreme apical margin; stigma and nervures fuscous. Legs dark red; coxæ blackish except at apex; trochanters red; anterior femora black at extreme base behind; middle femora with nearly basal half black behind; hind femora entirely blackish except at apex; tibiæ red except posterior pair very slightly suffused darkish behind; tarsi red; legs with rather abundant grayish hair. Abdomen darkish red, finely punctured and shining. Basal half of first dorsal segment black straight across, the apical margin of the tergite narrowly black, most noticeable near lateral margins; second tergite very slightly darkened postero-laterally. Ivory-white marks as follows: two small lateral spots on first tergite at posterior margin of the black; a broad band on second tergite, narrowed medially and almost interrupted minutely by small anterior and posterior emarginations on the median line; third tergite with two large cuneate marks laterally, almost hidden by the retraction of the segment; fifth tergite with a suggestion of white at the extreme apical margin. Abdominal segments with grayish-white hair near apical margins. Venter of abdomen red, except a blackish stripe on sternites 1 and 2, and a light spot at extreme apex of last ventral segment; base of first sternite with a black V-shaped mark. Apex red like abdomen, punctured, conspicuously notched.

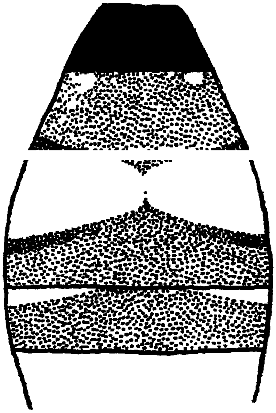

Fig. 1. Color pattern of first three abdominal tergites of *Nomada leucozona,* new species (diagrammatic).

This species is near *N. albofasciata* Smith, but differs from it by the larger size, head and thorax red and black, first abdominal segment without an interrupted fascia but with small inconspicuous lateral spots, hair of the head and thorax copious, scape red in front, scutellum red.

NOMADULA Cockerell

Male antennæ peculiar, anterior coxæ strongly spined, abdomen strongly punctured, the two sexes quite differently colored.

MALES

1.—Joint 4 of antennæ at least twice as long as 3, narrow, deformed along lateral edge; joint 5 toothed. Abdomen almost black with cream bands, that on tergite 1 usually interrupted. Apical plate very dark brown-red, edged with blackish. Pleural yellow spot inconspicuous. Hind surface of posterior femora red with blackish suffusion basally, sometimes with narrow blackish line. *scita* Cresson.

Joint 4 of antennæ not or hardly twice as long as 3, usually conspicuously less, more robust; joints 5–13 toothed beneath. Abdomen dark reddish-black with cream bands. Apical plate usually bright ferruginous, long, narrow. Pleural yellow spot large. Hind surface of posterior femora uniformly suffused with blackish............ ... .*semiscita* Cockerell.

Nomada (Nomadula) erythrochroa Cockerell

IDAHO.—Montpelier, July 6, 1920, one female (F. E. Lutz).

This species has been previously reported only from Washington State. Differs from the description in having a little black between ocelli, just behind wings, at base of hind coxæ behind, and at base of first abdominal tergite.

Nomada (Nomadula) scita Cresson

COLORADO.—Boulder, May 29, 1913, four males (Ellis), May 25, June 4 and 7, 1922, five males (F. E. Lutz). Elbert, June 9–11, 1922, one male (F. E. Lutz).

These vary in size from about 7 mm. to nearly 10 mm.

Nomada (Nomadula) semiscita Cockerell

COLORADO.—Boulder, May 29, 1913 one male (Ellis). Semper, May 25, 1919, two males (Jackson). Boulder, May 25 and June 7, 1922, three males (F. E. Lutz). Elbert, June 9–11, 1922, one male (F. E. Lutz).

These specimens are uniformly about 10 mm. long, with the exception of one (Semper, Colorado), which is about 8 mm. It is of interest to note the fact that both *scita* and *semiscita* are so frequently captured in company with each other. This may be due to the fact that their close relationship implies similarity in habitat, season, etc. It is conceivable that they represent variations or genetic modifications of the same species, but in this case it might be reasonable to except more intermediate forms than seem to have been found.

MICRONOMADA Cockerell

Anterior coxæ spined, antennæ ordinary, antennal joint 3 longer than 4, abdomen strongly punctured, apex of male usually notched.

MALES

About 10 mm. Punctures of head and thorax widely separated on a shining ground. Posterior margins of abdominal segments conspicuously impunctate, shining. Second cubital cell broader than tall, third narrowed above to less than one-fourth its basal breadth. Wings very dark................*putnami* Cresson.

About 9 mm. Less robust. Punctures of head and thorax much more dense, although not subcancellate. Posterior margins of abdominal segments less conspicuously impunctate. Second cubital as tall as, or taller than, broad. Third not so much narrowed above. Wings ordinary.......................*modesta* Cresson.

Nomada (Micronomada) putnami Cresson

COLORADO.—Colorado Springs, June 15–30, 1896, two males, one female (Wickham).

A female in Professor Cockerell's collection was compared and differed from the present specimen in having the third cubital narrowed only about one-half above, the wings blackish rather than reddish, the legs darker red (but with the same yellow marks), and the whole insect more blackish (reddish-black in the present insect). Professor Cockerell's specimen was from Boulder County, Colorado. The two males seem to be ordinary.

Nomada (Micronomada) modesta Cresson

COLORADO.—Eldorado Springs, June 23, 1918, one male (Jackson). Boulder, June 30, 1922, one male (F. E. Lutz).

On comparison with a male in Professor Cockerell's collection which has the apex black, it was found that one of these has the apex bright ferruginous, and the other is intermediate, having it a very dark red.

HOLONOMADA Robertson

Apical plate of male abdomen entire, antennal joint 3 of male longer than 4, mandibles simple, anterior coxæ not spined.

MALES

About 8.5 mm. Mesothorax wholly black; apex entire, slightly truncate, color a dark chocolate; apical margin of tergite 6 dark, almost black. *vincta* Say.

About 10 mm. Mesothorax yellow at lateral margins; apex sometimes very slightly notched, sometimes entire, truncate, color lemon-yellow; apical margin of tergite 6 light ferruginous. ... *zebrata* Cresson.

Nomada (Holonomada) vincta Say

COLORADO.—Canfield, August 15, 1922, one male (F. E. Lutz).

See discussion of *N. zebrata.*

Nomada (Holonomada) zebrata Cresson

COLORADO.—Canfield, August 15, 1922, two males (F. E. Lutz).

One of these males is typical *zebrata* as defined in the literature and as represented in my collection and in that of Professor Cockerell. The other seems fairly intermediate between this species and *vincta.* The proportions of the scutellum and postscutellum are those of *zebrata.* There is a faint suggestion of yellow lateral mesothoracic marks as in *zebrata.* But the color of the apical margin of the sixth abdominal tergite and of the apical plate is like that of *vincta.* All of the specimens of *vincta* and *zebrata* I have seen, with the exception of this one, are separable on the basis of this character, which seems to be fairly constant. Perhaps this is another instance of the possibility of hybridization between two very closely allied forms, or perhaps it represents an intermediate between two usually distinct varieties of the same species.

A specimen of *vincta heterochroa* Cockerell in Professor Cockerell's collection has the apex colored nearly as in *zebrata*, and it is very slightly notched, which might indicate a closer relationship to *zebrata* than to *vincta*.

Nomada (Holonomada) edwardsii Cresson

COLORADO.—Boulder, June 4, 1922, one female (F. E. Lutz).
UTAH.—Eureka, May 24, 1920, one female (Spaulding).

This seems to be an addition to the published fauna of Colorado, but is rather common at Boulder, both males and females being in my collection. There is no difference between the Boulder insect, that from Utah, and specimens from the Pacific Coast. There would appear to be a certain faunal continuity between northern Colorado and the West Coast by way of Idaho, Montana, Utah, and Wyoming.

HEMINOMADA Cockerell

Antennal joint 3 in both sexes usually shorter than 4, apex of male notched, both sexes usually with continuous yellow abdominal bands.

MALES

1.—Antennal joint 3 very short, not over one-third as long as 4; no supraclypeal mark . . . . *fragilis* Cresson.
Antennal joint 3 more than one-third as long as 4, usually about half as long . . . 2.

2.—Yellow spots on propodeum; mesonotum entirely black; all have postorbital yellow proceeding a short distance upward, more than one-third the distance up the eye; scutellum and postscutellum colored . . . . 3.
No yellow on propodeum; usually no postorbital yellow, but if so, then mesonotum is red, or scutellum is black, or light scutellar spots are small and the postscutellum is black . . . . 5.

3.—Basal nervure interstitial with nervulus or very slightly basad of it; lateral face-marks not proceeding to summit of eyes; pleural yellow spot extensive antero-posteriorly . . . . 4.
Basal nervure considerably basad of nervulus; lateral face-marks proceeding narrowly to top of eye; pleural yellow spot confined to anterior . . *civilis* Cresson.

4.—First and second transverse cubital nervures subparallel, making second cubital cell broad above, taller than broad; third cubital narrowed above to one-third its base, its top not much more than one-half that of second cubital; legs yellow and black, little red except basally . . . . *ornithica* Cockerell.

Second cubital cell more narrowed above, produced at its lower inner angle; third nearly as wide above as second; legs red with little yellow except on coxæ and front of anterior legs... ....*crawfordi* Cockerell.

5.—No yellow on first abdominal tergite, basal half black, and a reddish medial area placed transversely; venter mostly ferruginous with obscure blackish bands, and a divided narrow yellow band on sternite 3....*vicinalis* Cresson variety.

First abdominal segment with yellow; venter marked with yellow extensively..6.

6.—Abdominal segments 1–6 with clean-cut continuous yellow bands alternating with crisp black, segment 1 with at most a reddish interruption medially..7.

Abdominal segments with a tricolored effect of red, yellow, and black, the red interrupting the otherwise entire yellow bands, and the black at the bases of the segments.......................*modocorum* Cockerell, variety *a.*

7.—Head broad; heavily pubescent, that around antennæ, vertex, dorsum of thorax, and especially on the scutellum, bright red; on cheeks, face, pleura, etc., long and white; heavy white hair behind all femora; scape yellow in front; joint 4 of antennæ elongated, twice as long as broad, and not twice as long as 3, about as long as 13................................*ednæ* Cockerell.

Head narrower; more sparsely pubescent, and all of a uniformly pale golden color; scape black with a yellowish-red stripe in front; joint 4 of antennæ not elongated to nearly twice its width, not much longer than 3.
collinsiana Cockerell.

FEMALES

1.—Ground color of head and thorax black; legs bright red with very little black behind; tubercles yellow; tegulæ and scutellum ferruginous; ferruginous pleural marks; propodeum with two small red spots; abdomen red with bright yellow bands on all but first segment, interrupted on tergite 2; length about 9 mm., slender..................................*civilis* Cresson.

Ground color of head and thorax red; length at least 11 mm................2.

2.—No yellow on propodeum; no yellow on face, or at most an orange tint; antennæ red, not darkened behind apically, nor in any other portion; abdomen with entire bands, that on first tergite pale ferruginous except small lateral yellow spots; the second tergite with a discal rectangular ferruginous stain which does not interrupt the yellow band posteriorly; tubercles and tegulæ red; length 12 mm., somewhat slender..................*collinsiana* Cockerell.

Propodeum with lateral yellow marks; face with extensive yellow markings; bands on abdominal tergites 1–6, sometimes interrupted on 1; length 11 mm., robust...3.

3.—Scutellum red; yellow propodeal marks invade enclosure...*crawfordi* Cockerell.

Scutellum yellow; yellow propodeal marks do not invade enclosure.
luteoloides Robertson, variety.

Nomada (Heminomada) fragilis Cresson

COLORADO.—Boulder, June 6, 1922, one male (F. E. Lutz); June 7, 1922, one male (Frank B. Lutz). Plainview to Eldorado Springs, May 22, 1921, one male (Jackson).

One of these (Boulder) has fairly large scutellar spots, the others have the scutellum all black.

Nomada (Heminomada) civilis Cresson

UTAH.—Eureka, May 27, 1921, one male (Spalding).
WYOMING.—Cheyenne, June 11, 1920, one female (F. E. Lutz).

The female varies from the female described by Professor Cockerell in the Entomologist, April, 1909, in having the band on second segment entirely interrupted medially by the red, and in the scape which is not yellow in front but only a suffused orange-red.

Nomada (Heminomada) ornithica Cockerell

COLORADO.—Boulder, June 7, 1922, one male (F. E. Lutz).

This specimen has a clear-cut yellow spot at the antero-lateral corners of the mesonotum, just in front of the tegulæ. A distinctive feature is the conspicuous bell-shaped yellow mark on the first abdominal sternite. This reminds one of Cockerell's *tintinnabulum*, but in the latter the mark is on the first tergite and is black.

Nomada (Heminomada) crawfordi Cockerell

COLORADO.—Elbert, June 9–11, 1922, one male (F. E. Lutz). Jim Creek, near Boulder, June 21–23, 1922, one female (F. E. Lutz). Peaceful Valley, near Ward, July 5, 1922, one female (G. N. Strawbridge).

One of the females has the band on the first abdominal tergite complete, it being emarginate at the front medially. The other has the band divided to form lateral yellow marks.

Nomada (Heminomada) vicinalis Cresson

COLORADO.—Boulder, April 26, 1913, at *Salix*, one male (Ellis).

Nomada (Heminomada) ednæ Cockerell variety

UTAH.—Eureka, April 29, 1920, two males (Spalding).

The black marks behind the flagellum continue to the apex, the yellow dorsum of prothorax, pleural spots, and scutellar spots are absent. The basal nervure goes far basad of the nervulus.

Nomada (Heminomada) collinsiana Cockerell

COLORADO.—Boulder, April 28, 1913, at *Taraxacum*, one male (Ellis); April 27, 1913, at *Berberis*, one female (Ellis).

Nomada (Heminomada) modocorum Cockerell, variety *a*

COLORADO.—Plainview to Eldorado Springs, May 22, 1921, one male (Jackson). Boulder, May 29, 1922, one male (James Denham); June 6, 1922, four males (F. E. Lutz); June 7, 1922, one male (F. E. Lutz).

I refer these insects to this species with considerable uncertainty. They are close to *taraxacella*, but from Swenk's analysis of that species I do not believe these belong there. *N. modocorum*, on the other hand, has the basal nervure interstitial with the nervulus, while the specimens under consideration have it considerably basad. The third antennal joint is at least half as long as the fourth, the flagellum being blackened behind throughout its entire length. Some of the specimens have very small yellow spots on the apices of the scutellar lobes as mentioned by Cockerell (1911). All have the tegulæ ferruginous, the tubercles and a small irregular pleural spot yellow.

Nomada (Heminomada) luteoloides Robertson, variety

UTAH.—Eureka, May 29, 1920, three females (Spalding).

I am unable to find any secure basis upon which to distinguish these from *luteoloides*, which is an essentially eastern species. The differences are entirely those of coloration, with the exception that the Utah insects have a broader face. The specimens compared are from Wisconsin and Georgia.

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TWO NEW SPECIES OF *SYMPHOROMYIA* (RHAGIONIDÆ, DIPTERA) FROM THE EASTERN UNITED STATES

BY M. D. LEONARD[1]

During a recent visit to The American Museum of Natural History, I had the pleasure of examining several species of Rhagionidæ, collected during recent years, among which were the two species described in the following pages. The types are in The American Museum of Natural History.

KEY TO FEMALES OF EASTERN SPECIES

1.—Femora black or brown..2.
  Femora reddish or yellowish..5.
2.—Third antennal segment reddish yellow....................*pleuralis* Curran.
  Third antennal segment black or brown..3.
3.—Front not wider than eye from dorsal view..4.
  Front much wider than eye..6.
4.—Tibiæ yellowish, slightly brownish apically; tarsi mostly pale...*hirta* Johnson.
  Tibiæ reddish brown, the bases broadly reddish; tarsi black, more or less reddish brown at the base..*currani*, n. sp.
5.—Pile of the front and mesonotum black, coarse and long (Colorado and Oregon). *fulvipes* Bigot.
  Pile of the front black and short, that of the mesonotum mostly whitish. *cinerea* Johnson.
6.—Abdomen yellow pilose..*montana* Aldrich.
  Abdomen black pilose, the sides of the first and second segments with yellow pile. *algens*, n. sp.

Symphoromyia algens, new species

Most nearly related to *S. montana* Aldrich, but differs by the pile of the abdomen being black instead of pale in both sexes and in the male the first antennal segment being more than twice as wide as the third. Length, 6 to 6.5 mm.

MALE.—Head grayish pollinose; first antennal segment more than twice as wide as third and with long black hairs; the second segment with shorter black hairs; third segment black. Face bare, gray pollinose; cheeks, palpi and vertical triangle with long blackish hairs, the palpi blackish in ground color.

Thorax grayish pollinose, the mesonotum with three broad dark vittæ leaving two narrow lines and the lateral edges and posterior border grayish pollinose, blackish pilose; pleura grayish pollinose, hypopleural pile pale; halteres with knob blackish and stalk yellowish.

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[1] Insular Experiment Station, Rio Piedras, Porto Rico.

Abdomen blackish in ground color, somewhat grayish pollinose and with black pile except on the first segment and on the sides of the second where it is pale.

Legs blackish, knees narrowly somewhat paler.

Wings tinged with pale brownish; stigma diffused.

FEMALE.—Length, 7 to 7.5 mm. Head with the front at least twice as wide as eye, mostly grayish pollinose on lower half and mostly brownish pollinose on upper half, the pile black. First antennal segment about as wide as third and with black pile; palpi dark, with mixed black and pale hairs; pile of cheeks mostly pale.

Thorax grayish pollinose, with three broad brownish vittæ, but narrower than those in the male, the outer two not reaching either the anterior or posterior border and somewhat broken at the sutures; pile black. Halteres and hypopleural pile as in male.

Abdomen grayish pollinose, pile short and blackish, but pale and longer on the sides of the first and second segments.

Legs a little paler than in the male.

TYPES.—Holotype, male, Mt. Washington, N. H.; allotype, female, Mt. Washington, N. H. Paratypes: female, Mt. Washington (Mrs. Slosson), in American Museum of Natural History; seven males and three females, Bradore Bay, and Natashquan, Quebec, Canada, July 27, and August 1 and 2, 1929 (W. J. Brown), in Canadian National Collection.

Symphoromyia currani, new species

Apparently most nearly related to *hirta* Johnson, but the tibiæ are reddish brown instead of yellowish and the tarsi are mostly black intsead of being mostly pale. Length, about 6.5 mm.

FEMALE.—Head grayish pollinose; front and first two antennal segments with black hairs, longer and more numerous on the vertex and frontal triangle. Third segment of antennæ black. Face bare; palpi reddish, with moderately long black hairs below and at base above.

Mesonotum grayish pollinose, subshining, with three brownish vittæ, the median one tending to be narrowly divided toward the front along the median line and the lateral ones broken at the suture. Scutellum and pleura grayish pollinose. Hypopleural pile pale yellowish. Halteres yellowish.

Abdomen gray pollinose, subshining; hair appressed and pale.

Legs with femora blackish; tibiæ reddish brown, the bases broadly reddish; tarsi blackish but more or less reddish brown at the base.

Wings tinged with pale brownish; stigma diffused.

TYPE.—Female, Avon Old Farms, Avon, Connecticut, June 22, 1929 (Curran).

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NOTES ON THE ANIMAL LIFE OF THERMAL WATERS IN THE YELLOWSTONE NATIONAL PARK

By Frank E. Lutz

The Yellowstone National Park offers ideal and unexcelled opportunities for studying the ecology of thermal waters. The following notes are based on brief and scattered observations made in July, 1930. One problem that is indirectly connected with thermal waters seems interesting but was not even touched. It [illegible] as to whether the warming of the ground by the subsurface heat in such regions as the Old Faithful district has resulted in the maintainance of a more southern fauna there than in immediately adjacent districts of [illegible] altitude.

A great deal of the large amount of work which has been done on the animal life of American thermal waters has been based on just such short visits to one or to many springs. These visits have resulted in much valuable information but it seems that a long stay with daily and even hourly observations of selected springs or streams in such a region as the Yellowstone might add still more to our knowledge of their problems—or to the mystery of them. One reason for this is that there are often rapid changes in the thermal and other conditions of given springs or streams, changes which, if not known, would make a single observation decidedly misleading.

It is a self-evident principle of ecology that among environmental factors those that are both important in themselves and different in different places are the most influential in determining distribution. Although temperature is the evident characteristic of thermal waters, the dissolved chemicals, specific gravity and especially the recently popular p_H have been noted by the more thorough observers. Which of these is ecologically basic?

Just north of Butterfly Cone in the Old Faithful district there is a pool ("25A") somewhat more than a meter in diameter and in depth. Its banks are muddy and its temperature at the various times when it was measured was within a degree of 24°C. It was "alive" with minute Crustacea (chiefly *Simocephalus serratulus*) and there were also numerous Notonectidæ. About six meters from this pool and in the same sort of soil was a larger (about ten meters in diameter) pool ("25B"). The temperature of its water at the edges was about 44° C. but without doubt it was warmer near the center. So far as I could determine, there was no animal life of any kind in this pool but there was a fair growth of algæ.

Water was taken from the second ("25B") pool and allowed to cool. When it had reached 24° a hundred or more of the Crustacea from the first ("25A") pool were put into it and set aside to await results. After three days all of the Crustacea, so far as I could determine, were still alive, indicating that, whatever minor or slowly-acting influence other factors may have had, the difference in temperature was very important. This was further confirmed by the reverse experiment of partly filling a large test-tube with Crustacea and water from the 24° pool and then floating this tube in the 44° one. Within less than half an hour after the water in the tube had reached the temperature of the pool all of the Crustacea were dead.

Possibly because their actions could be more easily observed, the backswimmers (Notonectidæ) were somewhat more dramatic when subjected to the same experiments. Nine of them, with 24° water from their pool, were put into an olive bottle which was then set in a shallow part of the warmer pool. In six minutes the water in the bottle had reached 35.5° and the bugs had noticeably increased their activity. Three minutes later the temperature was 38° and the bugs were not only very active but they were, for the most part, dorsal side up and trying to crawl out of the water. In three more minutes the temperature had risen to 39° and the bugs were in evident distress. When the water had reached 40° the wings of several bugs were outspread as in death; at 40.2° all were quiet except for spasmodic twitchings of legs; and at 41.5°, twenty-seven minutes after starting the experiment, all were dead.

Of course, what happens in nature is that, if a notonectid flying from pool to pool alights in one that is too warm for it, it immediately takes flight again unless the second pool is so hot as to paralyze the insect suddenly. This was demonstrated by nearly filling a bottle with water at 38°C. and putting several notonectids from the "25A" pool into it. They immediately came to the surface and tried to fly out, one succeeding, the others slipping back and trying again, only to hit against the opposite side of the bottle. When the water had cooled to 36° they seemed more content to stay in it and at 35° even fresh specimens made no attempt to escape.

Such being the case, it is quite evident that a temperature of 38° or higher would alone keep these insects out of a pool, no matter what be the chemical content, specific gravity, or p_H. This experimenting was carried a bit further by using the Crustacea as test material. Water was taken from a large variety of hot springs in the Old Faithful district, including Beach Spring, Riverside Geyser and Old Faithful itself. These water samples were cooled and stocked with plankton from the "25A" pool. No case was found in which such plankton did not live without any apparent increase in death-rate for three days, the arbitrary length of the experiments.

The relation between temperature and the distribution of aquatic insects was beautifully shown in the very shallow water at the edge of a marshy spot draining a hot spring in the Norris district. Beetles (*Enochrus hamiltoni* and *Tropisternus californicus*) and mosquito larvæ which were abundant where the temperature was less than 37° were practically absent where, less than a meter distant, it was more than 38°. If driven by hand into the warmer water they immediately left it for the cooler, although it is quite improbable that in these cases there was any, or, at least, any noticeable-to-them, change in specific gravity or p_H.

I put one of the larger water-beetles (*Tropisternus*) with water from this pool into a tube and held the tube in a hot spring. In about a minute the temperature had reached 45.4° and the beetle was dead. A mating pair of these beetles was tested in a similar manner except that the tube was kept in the hot spring for only a few seconds at a time so that the temperature increased gradually to 45°C. One of the beetles died at 44° but the other, which at 45° had stretched its legs out ventrally in a death pose and was floating, motionless, with its dorsum and not its anal end at the surface, recovered movement as the water was allowed to cool. By the next day it was as lively as ever.

The water entering Black Sand Pool in the Old Faithful district is said to be superheated. At the margin of a small pool fed by the overflow of Black Sand the temperature of the water was only 24°C. There was no higher vegetation at this point, the bottom being small pieces of geyser "formation" slightly covered with a brown growth (algæ?). There were numerous small beetles of three families and five genera: *Bidessus affinis* and *Deronectes striatellus* of the Dytiscidæ; *Enochrus carinatus* and *Laccobius agilis* of the Hydrophilidæ; and either *Helmis divergens* or a closely related species of the Helmidæ. Less than a meter nearer the center of the pool the temperature of the water was 32° and there were no beetles. Experiments made in the manner previously described showed that these beetles survived heating to 41° for a short time but were distinctly uncomfortable at, say, 35° and died at 45°C. It seems rather clear that temperature is a major and probably the sole inorganic factor in determining their distribution in this pool and probably elsewhere.

An exceedingly interesting lay-out was afforded by rivulets flowing from small hot springs which were located in the rather open pine forest N.E. of Solitary Geyser in the Old Faithful district. Taking one such rivulet as an example, the water as it came out of the ground had a temperature of 48°C. Since the slope was moderately steep, the rivulet, in places not 20 cm. wide, resembled the common idea of a babbling mountain brook except for its temperature. At its source the stream was much choked (entirely covered in one place) by a thick growth of stringy, slimy, matted algæ such as are characteristic of thermal waters. No animal life was found in the water at this point. It is to be expected that the algæ, as well as the flowing of the water, give it as much oxygen as the temperature allows.

Roughly 25 meters below its source the stream's temperature had dropped to about 44° C. Thermal algæ still covered the bottom but moss grew on the bank close to the water's edge. However, I still could find no animal life in the water.

Roughly 40 meters below the stream's source the current was very swift and the temperature 42°. Thermal algæ were present but not so luxuriant and there were in it the red dipterous larvæ (*Tanytarsus* sp.)[1] characteristic of thermal waters; but no other animal life was found. These larvæ can survive at least short experimental exposures to temperatures higher than 42° and probably could do so in nature. However, at even slightly higher temperatures they become active, crawl out of the muck or algæ, and swim about with bending motions of the body. In a stream such as the one under discussion this would naturally result in their going with the current and usually into cooler water. Therefore, it is probable that they were not found nearer the source of this stream, not because they could not withstand even the temperatures there but, because any even slight increase in temperature due to an increase in the volume of hot water coming out of the spring would result in their becoming active and floating down-stream into cooler water.

That this reaction of chironomid larvæ does not always result favorably was evident in the Norris Basin where a small, warm stream, flowing across a flat, passed through a pool kept hot by a thermal spring. The temperature of the stream as it entered the pool was 36° and as it left was 42°C. The temperature of the pool varied from place to place depending on the currents but averaged well above 55°C. On July 4 the stream was so full of wriggling red larvæ of a species of *Chironomus* near *tentans* that they were floating with the current at an average rate of 38 per minute. All were alive as they entered one side of the pool and all were dead as the current floated them out at the other side. Circumstances did not permit me to follow up the stream to see what had started this striking mass-movement of larvæ but probably it was due to the increased activity of a hot spring warming by a few degrees the water in which they were breeding.

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[1] These and other identifications of Diptera are by Mr. C. H. Curran; those of Coleoptera, by Mr. A. J. Mutchler; and those of lower invertebrates by Dr. W. G. Van Name.

Returning to the description of the stream in the Old Faithful district, the temperature (42°) already given as that of the stream about 40 meters below its source was taken at ten o'clock in the morning. At two o'clock that afternoon the temperature at exactly the same point was 43°, the difference possibly being due to the fact that the morning was very cloudy but in the afternoon the sun was shining on the water. There had in this case been no noticeable change in the temperature of the spring.

Approximately 60 meters from its source the stream was swift but with eddies. The temperature was 41° at about 4:00 P.M. Then there was a light shower for nearly an hour. About half an hour after the shower stopped the temperature was only 39°C. There were none of the thermal algæ which were so abundant above, unless the very short, dark growth on the pebbles was a depauperate representative. *Tanytarsus* larvæ were present and also hydrachnids which I have tentatively identified as *Thermacarus nevadensis* and a beetle, *Paracymus subcupreus*.

Approximately 75 meters from the stream's source the temperature at 5:40 P.M. (ten minutes after noting that the temperature was 39° about 15 meters farther up the stream) was 37° but it was 38° at ten o'clock the next morning and it probably reached at least 39° on clear days. Mr. Curran identifies the rather abundant red dipterous larvæ found here as *Palpomyia* sp. A small crustacean (*Hyalella knickerbockeri*) was another new element in the fauna, as was the beetle *Helmis similis*. See Table 1 for the constitution of observed fauna here and at other points along this stream.

Approximately 105 meters from the stream's source the temperature was 35.5°C. The brook seemed otherwise about as before except that the growth on the stones was a little greener. No specimens of the hydrachnid and no *P. subcupreus* were found but a heteropteran (*Ambrysus heidemanni* Montandon, identified by Mr. R. L. Usinger) had come into the fauna. *Palpomyia* larvæ were still present.

Approximate Meters from Source	Temp	Thermal Algæ	*Tanytarsus* (Diptera)	*Thermacarus* (Hydrachnidæ)	*Paracymus* (Coleoptera)	*Palpomyia* (Diptera)	*Helmis similis* (Coleoptera)	*Hyalella* (Crustacea)	*Ambrysus* (Hemiptera)	*Tanypus* (Diptera)	Trichoptera	Ephemerida	Odonata	*Helmis divergens?* (Coleoptera)	*Simulium* (Diptera)
0	48°	×													
25	44°	×													
40	42°	×	×												
60	40°		×	×	×										
75	38°		×	×	×	×	×	×							
105	36°		×			×	×	×	×						
135	35°		×			×	×	×	×	×					
165	33°					×	×	×	×	×	×				
195	31°						×	×	×	×	×				
225	29°						×	×	×	×	×				
230	35°		×			×	×	×	×						
315	33°						×	×	×	×	×				
705	26°						×	×	×		×	×	×	×	
885	24°						×	×	×		×	×	×	×	×

Table 1.—See text for explanations.

Approximately 135 meters from the stream's source the temperature was 35.5°. The stream was still swift but not so much choked with sticks and stones, hence not so turbulent. The fauna seemed to be that of the 105-meter point, except that dipterous larvæ of the genus *Tanypus* had come in.

Approximately 165 meters from the stream's source the temperature was 33° at 2:00 P.M. As the midday sun had been shining brightly and the brook was especially exposed for some distance above this point by a windfall of trees, 33° is probably fairly close to the maximum. Sedges were growing in the water. Beetles (*Helmis similis*) and Crustacea (*Hyalella knickerbockeri*) were abundant but no *Tanytarsus* larvæ were found. Offsetting their absence were caddis larvæ as a new element in the fauna.

Approximately 180 meters from its source the stream took a winding course with a slower current among young pines. At about 195 meters the temperature was 31° at 3:30 P.M. The pebbles were fairly clear of algæ and there was no other noticeable aquatic vegetation. The fauna was chiefly made up of the heteropteron (*Ambrysus heidemanni*) and caddis larvæ of two sorts: one having a light-colored abdomen and living in fixed masses of small pebbles and one having a green abdomen and living in portable cases. There were a few *H. similis* and Crustacea but *Palpomyia* had apparently dropped out.

Approximately 225 meters from its source and a meter before it joins another, larger, and warmer stream the temperature of the stream we have been following was 29°C. in the late afternoon. There was a light drizzle of rain most of that night and at 10:30 the next morning the temperature of the water at this point was only 26.5°C. The fauna had the same elements as at the 195-meter point, although the proportions were somewhat different, the light-abdomened caddis larvæ being particularly abundant.

This joining of streams started, as will be seen, a new series in the faunal changes. When the temperature in the smaller stream a meter above the junction was only 26.5° the temperature of the larger stream at a corresponding point was 35°C. As the day was still damp and cold, it is probable that the water in the larger stream at this point often reaches at least 37°. Just below the junction, average temperature about 35°, *Tanytarsus* larvæ were very abundant. There were few *Helmis similis* and most of them were dead. Several *Ambrysus heidemanni* and several *Hyalella knickerbockeri* were found after much searching, but no caddis. In other words, it was the fauna of the smaller stream at a point about 100 meters above, where the temperature was about the same.

The temperature 30 meters below the junction of these streams was 33°; 60 meters below the junction it was 32°; and about 90 meters below the junction it was 31.5° at one time but less than an hour later, with bright sun, it was 33°C. At this point there was the fauna of the same temperature 150 meters above, except that no *Palpomyia* larvæ were taken.

Temperatures at various points below the junction were measured in rapid succession as follows: 150 meters, 32°; 210 meters, 31°; 300 meters, 30°; 390 meters, 29°; 480 meters (after tumbling down the very steep side of a hill), only 26°C. At this latter point there were filamentous algæ in the stream while yellow monkshood and other herbs crowded the bank. *Hyalella knickerbockeri, Helmis similis,* and the *Ambrysus* were still present but they had been joined by a worm (*Plannaria fore-*

manni), another beetle (*Helmis divergens?*), may-fly and damsel-fly larvæ, and caddis larvæ in spiral cases. *Tanypus* had apparently dropped out.

About 660 meters below the junction with the warmer stream (roughly 900 meters from the source of the stream we have been following) the temperature of the water was only 24.5°C. and the presence of *Simulium* larvæ gave the fauna a distinctly "normal brook" aspect in spite of the few remnants from the warmer upper parts. Probably the idea in that last clause should be reversed, for it is likely that the fauna of cool water goes as far into the warm as possible and that the "tension" is not from the warm into the cool.

The heteropteron, *Ambrysus heidemanni*, is one of the more interesting insects of this stream. Brues recorded it from a hot (34°) spring near Bridgeport, California, as well as from Yellowstone, the type locality. In the Yellowstone he found it "in water at 35.5° which was highly charged with silica. It would appear, therefore, that this insect occurs generally in thermal springs of moderate temperature. One of its relatives, *Naucoris cimicoides* of Europe occurs in saline water, but no other members of the family have been found in thermal springs" (Brues, 1928, Proc. Amer. Acad. Arts Sci., LXIII, p. 172).

Since Brues found it nowhere else in his extensive survey it may not really occur generally but it was certainly abundant in the Yellowstone in 1930 at a number of places where the temperature was between 25 and 35°C. It will be noted that in the stream just discussed it was found where the water was from 35 to about 39° but no warmer. Experiments in warming water into which mature specimens had been put showed that their movements became greatly accelerated at 39°C. One specimen, when raised to 41.5° for just a few seconds and then allowed to cool slowly appeared to have died. When taken out of the water it revived somewhat but was sluggish and moved only when stimulated. Put into water at 19° it became active. The temperature was then raised to 43° and allowed to drop, reaching 41.5° in a minute. The bug ceased active movements, legs outstretched and twitching slightly. In three minutes the water had cooled to 31° but the bug did not respond to mechanical stimulation. After having been taken out of the water for ten minutes it still did not move. When returned to water at 20° it moved slightly almost immediately and slowly revived until it was apparently fairly normal but sluggish.

Any increase, such as is common, in the thermal activity at the source of this stream would quickly raise the temperature at 100 meters below. Apparently the *Ambrysus* would voluntarily start moving into cooler water if the temperature approached 39° and if the temperature reached, say, 41° the insect would lose its power of movement and be washed involuntarily to cooler water, where it would revive and continue to live unless, when the thermal activity had lessened, it crawled up-stream again. This would be true whatever the chemical factors of the environment might be. Admittedly these chemical factors may, if extreme enough, prevent it from living in water of suitable temperature but its absence from such a place at a given time proves little about the fitness of that place at that time. This is particuarly true of pools which change their temperature rather markedly from time to time and from which at least the young of this species could not easily escape if the water got too hot.

Further examples of the faunistic effect of local and occasional differences of temperature were seen along the banks of the Firehole River where it was joined by the hot overflow of geysers. One such place is the outlet of Sawmill Geyser, but a more spectacular one is Riverside Geyser.

The latter shoots diagonally up-stream into Firehole River but for an hour or two just before an eruption it pours hot water into the brink of the river. When the geyser was not overflowing, the temperature of the water at the river's edge was from 19 to 22°C. When, however, the geyser was overflowing strongly, the temperature thirty feet below the overflow was greater than 50° (more than an insect can stand); fifty feet below the overflow it was 39° and eighty feet below it was 28°C. These are merely typical figures. As a matter of fact, the temperature even during a fairly constant overflow varied five degrees or more in a few minutes at a given place due to swirls in the water. The point is that the more or less sedentary insect larvæ must be prepared to withstand the maximum heat at the place in which they are living. If it gets too hot they either let go and are washed into cooler water or they die.

On the other hand, the water even at the place of overflow may be too cool during the geyser's quiescent hours for extremely thermal things, this probably explaining their absence. In fact, for some feet below the geyser the river's edge seemed to be almost lifeless. Just upstream from the geyser, however, the normal cool-water flora and fauna flourished in spite of the fact that the geyser errupts in that direction. As was determined by standing in it, the spray is not uncomfortably hot when it strikes the river and it is then, of course, both cooled and rapidly carried down-stream.

It is difficult to draw any other conclusion from these observations, which are all too scant and should be extended in detail throughout a season or longer, than that temperature is the principal inorganic environmental factor in controlling the distribution of life in these waters. While the possible lesser effects of chemical characteristics should be kept in mind and sought, only experimental evidence will prove their importance.

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597, 58 G (51)

SOME CHINESE FRESH-WATER FISHES[1]

BY J. T. NICHOLS

XXIX.—A NEW GOBY FROM HOKOU, KIANGSI

Small fresh-water gobies placed by the writer in the subgenus *Rhinogobius* are plentiful in various parts of China. Much of such material in The American Museum of Natural History is referable to *Gobius hadropterus* (Jordan and Snyder) described from Japan, assuming this to be a widely distributed and variable form. Material of *Gobius giurinus* Rutter, which, though closely related, seems to be differentiable, also has been examined. *Gobius cliffordpopei* Nichols, described from Tungting Lake, and another fish from Chungan Hsien, northwestern Fukien, identified with *Gobius davidi*[2] Sauvage and Dabry de Thiersant from western Chekiang, are considerably different and apparently are dwarf species. From Hokou, Kiangsi, we have a nice series referable to *G. hadropterus*, as well as three specimens that obviously are quite different though with the same type of color pattern; in various ways these specimens are more like *Gobius davidi* from Chungan Hsien, which has an unlike color pattern, and they apparently represent a third dwarf form, as follows.

Gobius cheni,[3] new species

DESCRIPTION OF TYPE.—No. 9694, American Museum of Natural History, from Hokou, northeastern Kiangsi, collected June 22 to July 12, 1926, under the direction of Clifford H. Pope.

Length to base of caudal, 55 mm. Depth in this length, 6.9; head, 3.5. Eye in head, 4.5; snout, 3.2; maxillary, 2.6; width of head, 1.7; depth of peduncle, 3; its length (from anal axil), 1.4; pectoral, 1.4; ventrals, 2.2; longest dorsal spine, 2.4; longest dorsal ray, 2.2; longest anal ray, 2.3; caudal, 1.4. Interorbital in eye, 2.7.

Dorsal VI–9; anal 8½. Scales, 34. No canine teeth.

Snout narrow, back of head depressed, lower surfaces flattened, tail slightly compressed. Eyes close together; superolateral; lower jaw appreciably projecting; mouth almost horizontal, maxillary to under front of pupil; gill-openings extending forward to under hind margin of preopercle. Origin of first dorsal equidistant from end of snout and middle of anal base; pectoral reaching two-thirds the distance to anal, much beyond the united ventrals which form an almost circular disk; caudal rounded, subacuminate. Scales absent or suppressed on breast, head, nape and midline of back before the dorsal. Head, back and sides with blackish spots; and a row of about nine irregular blotches mostly slightly below middle of side. Dorsals spotted and caudal with five or six irregular cross-bars; pectoral with a dark spot on its base, closely followed by a short, and then a longer more diffuse bar.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History, Contribution No. 110.

[2] Nichols, 1931, Amer. Museum Novitates No. 449, p. 3.

[3] Named for the collector and tiger hunter Ch'en Ti-Ti, widely known under the name "Da-Da"

The other two specimens have the following comparable measurements respectively:

Length, 47 mm., 52 mm.; depth, 6.8, 7.5; head, 3.6, 3.4; eye, 4.4, 4.6; maxillary, 2.6, 2.5; ventrals, 1.9. 1.8; dorsal rays, VI–9, VI–10; anal, 8,8; scales, 35, 34; lower jaw slightly projecting, appreciably projecting.

Gobius hadropterus from Hokou is deeper bodied, with back in front of the dorsal completely scaled, and ventral disk less short and circular (at least in comparably small specimens). The following table gives the above measurements of twelve such specimens.

Length	Depth	Head	Eye	Maxillary	Ventrals	Dorsal	Anal	Scales
49 mm.	4.7	3.3	4.5	2.6	1.4	VI–10	10	31
54	5	3.4	4.4	2.2	1.5	VI–9	9	31
54	4.7	3.5	4.4	2.4	1.5	VI–9	9	32
54	4.8	3.5	4.7	2.4	1.4	VI–9½	9	31
54	4.8	3.3	5	2.3	1.4	VI–9	9	32
55	5	3.4	4.5	2.4	1.4	VI–9	8	31
55	5	3.4	4.4	2.5	broken	VI–9	9	30
56	4.7	3.3	4.4	2.2	1.4	VI–8	9	30
57	4.3	3.5	5	2.3	1.4	VI–9	8	31
62	5	3.2	5.6	2.2	1.5	VI–9	8	31
70	4.8	3.3	5.7	2.2	1.5	VI–9	9	30
77	4.7	3.2	5.5	1.9	1.7	VI–9	10	32

Of these specimens, three have the lower jaw slightly projecting two slightly included, and seven the jaws equal.

In *Gobius davidi* from Chungan Hsien, a row or two of scales are sometimes noticeable crossing the back before the dorsal, but the condition is more like that in *G. cheni* than like the fully scaled *G. hadropterus*. The color pattern is quite different, tending toward a narrow streak posteriorly in the midline of side instead of the lateral blotches; and frequently toward dusky coloration.

A table of comparable measurements of ten specimens follows.

Length	Depth	Head	Eye	Maxillary	Ventrals	Dorsal	Anal	Scales
36 mm.	5	3.3	4.4	2.7	1.8	VI–9	9	30
40	6.2	3.4	4.2	3	1.9	VI–10	9	30
42	5.8	3.4	4.3	2.6	2.2	VI–10	9	31
44	6	3.5	4.3	2.6	2.2	VI–9	8	31?
48	6.1	3.2	5.3	2.3	2.5	VI–9½	9	31
48	6.4	3.3	5.5	2.4	2.4	VI–9	9	30
49	6.4	3.5	5	2.7	2	VI–10	9	31
51	6.5	3.5	4.8	2.7	2.4	VI–9	8	32
52	6.5	3.3	5.1	2.3	2.3	VI–10	9	31
54	7	3.2	5.4	2.2	2.6	VI–9	9	31

Of these specimens, two have the lower jaw appreciably projecting, seven slightly projecting, and one the jaws equal. The four specimens of 48, 52, and 54 mm., are presumably males, with more dusky color, high dorsal fins, and big mouths as secondary sexual characters.

XXX.—SIX TYPE SPECIMENS FIGURED

It is our purpose to figure all the various species of Chinese fresh-water fishes described as new in American Museum Novitates from time to time, but it has not always been feasible to do so without unduly delaying publication; hence, we present here figures of the types of six species described in 1930 and 1931.

Siniperca elongata Nichols, 1930, Amer. Mus. Novitates, No. 431, p. 1. Kienyang, northwestern Fukien.

Siniperca obscura Nichols, 1930, Amer. Mus. Novitates, No. 431, p. 2. Hokou, northeastern Kiangsi.

Sarcochelichthys (Barbodon) parvus Nichols, 1930, Amer. Mus. Novitates, No. 431, p. 5. Hokou, northeastern Kiangsi.

Sarcocheilichthys kiangsiensis Nichols, 1930, Amer. Mus. Novitates, No. 431, p. 6. Hokou, northeastern Kiangsi.

Leiocassis tenuifurcatus Nichols, 1931, Amer. Mus. Novitates, No. 449, p. 1. Chungan Hsien, northwestern Fukien.

Botia compressicauda Nichols, 1931, Amer. Mus. Novitates, No. 449, p. 2. Chungan Hsien, northwestern Fukien.

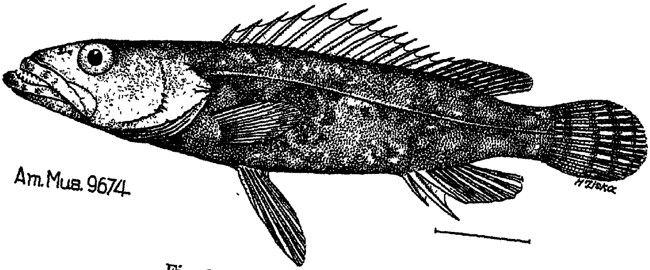

Fig. 1. *Siniperca elongata*, type.

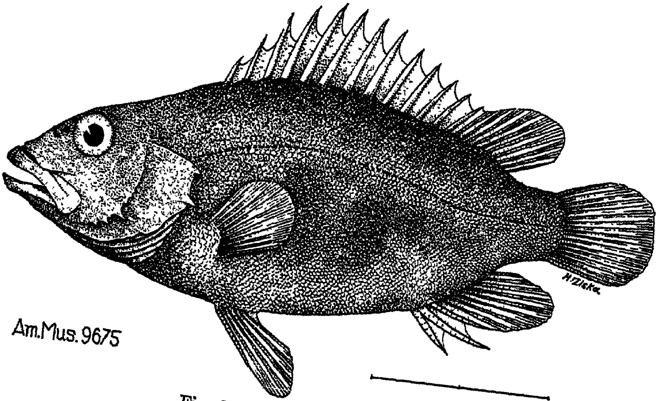

Fig. 2. *Siniperca obscura*, type.

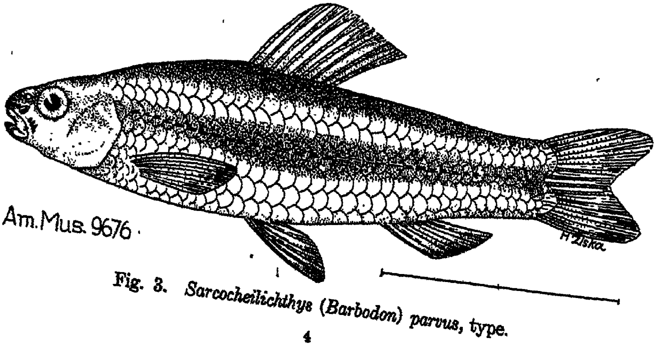

Fig. 3. *Sarcocheilichthys (Barbodon) parvus*, type.

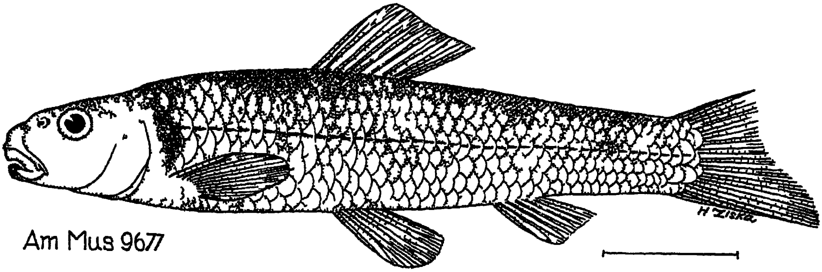

Fig 4 *Sarcocheilichthys kiangsiensis*, type

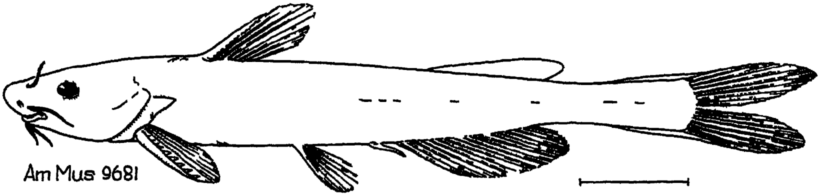

Fig 5. *Leiocassis tenuifurcatus*, type.

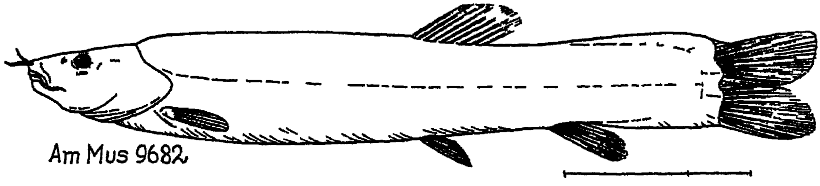

Fig. 6. *Botia compressicauda*, type

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STUDIES OF PERUVIAN BIRDS. I

NEW AND OTHER BIRDS FROM PERU, ECUADOR, AND BRAZIL

By John T. Zimmer

In December, 1910, Dr. Frank M. Chapman inaugurated a plan for the preparation of a series of monographs dealing with the origin and distribution of the bird-life of the Andes. This plan already has borne notable fruit in the shape of two volumes by Dr. Chapman on two of the Andean countries. The first of these to appear was 'The Distribution of Bird-Life in Colombia,' issued in 1916 as volume XXXVI of the Bulletin of The American Museum of Natural History, with 739 pages, 41 plates, and 21 text-figures. The next was 'The Distribution of Bird-Life in Ecuador,' published in 1926 as volume LV of the same series, with 797 pages, 30 plates, and 20 text-figures. These comprehensive reports were based upon carefully planned field work by The American Museum of Natural History.

Continuing southward from Ecuador along the chain of the Andes, the next country to be treated is Peru. The work of assembling the requisite collection from this country was begun soon after the plan for the series of monographs was inaugurated and before the first volume was prepared. The foundation of the collection was already laid down through the acquisition in 1901 of about one hundred birds collected at Inca Mine by H. H. Keays. In 1913, R. H. Beck, working the coast of South America on the Brewster-Sanford South American Expedition, spent about eight months on the coast and islands of Peru and also crossed the highlands to Lake Titicaca. His important collections from Peru are incorporated into the series.

When the work in Colombia was well advanced, special collectors were put into both Ecuador and Peru. In 1915, Harry and Casimir Watkins, resident naturalists of long standing in the latter country, commenced field work for The American Museum of Natural History, first sending in a small collection made in the latter part of 1914. In 1916, Dr. Chapman, accompanied by George K. Cherrie, visited the Urubamba Valley in connection with the preparation of a special report on the birds of that restricted region, based on the material collected by the joint expedition of Yale University and the National Geographic Society, of which Edmund Heller was the field naturalist, and that secured by Dr. Chapman's party. The report on the birds of this region was published in 1921 by Dr. Chapman, as Bulletin 117 of the United States National Museum. In the field, Dr. Chapman was joined by Harry Watkins, who later, in 1917, visited the head of the valley at La Raya and added much material to the excellent series of birds already secured from that interesting region. A series of duplicates of Heller's collection was obtained by the Museum and complemented the representation already at hand. Watkins remained in the employ of the American Museum until 1926, visiting various parts of the country, carefully selected for their bearing on the problems of distribution and life zones; and the excellent skins now at hand, sent in by him, testify to his energy and skill as a collector.

Meanwhile the coast and islands of Peru were being explored in 1919 and 1920 by Robert Cushman Murphy, under the joint auspices of the American Museum, the Brooklyn Museum, and the American Geographical Society. The birds obtained in the course of this work were largely acquired by the American Museum. Again in 1924 and 1925, Dr. Murphy revisited Peru for this museum and completed the survey of the northern coast and islands in the neighborhood of the Gulf of Guayaquil.

When the work in Ecuador was completed in 1926, the experienced native collectors, Carlos Olalla and his sons, were moved from Ecuador into northeastern Peru, and thence southward to the mouth of the Urubamba River, and until well into 1928 they continued to send extensive collections to the museum from that interesting region. G. H. H. Tate, of the American Museum staff, extended his investigations in other parts of South America to include a visit to Arequipa, Peru, in 1926, and the number of bird skins in the Peruvian collection was increased further from that source.

A more complete history of these collections and collectors will be given in the final Peruvian report, and it is unnecessary to go into greater detail here. There has been a representative of the American Museum continuously in the field in Peru from at least 1915 to 1928, and the result of all such activities has been the assemblage of some 17,000 birdskins from many parts of the country, a collection unequalled in the history of Peruvian ornithology.

Portions of this collection have been examined by Dr. Chapman during the preparation of the report on the bird-life of Ecuador, and numerous references to Peruvian specimens and species, given in various preliminary papers and in the final volume, not only served to indicate, in some measure, the progress of the field work in Peru, but also to lay a foundation on the network of interrelations between the birds of Peru and those of its northern neighbor.

The present author has undertaken a comprehensive study of the bird-life of Peru for the purpose of preparing the complete volume on its distribution. Necessarily this project requires much preliminary taxonomic work to determine the identity of the Peruvian forms and their relationship to the forms of other Neotropical countries. The amount of material to be examined is considerable and the presentation of the taxonomic problems in full detail in the final volume is open to various objections. Among these are, first, the question of space; secondly, the fact that there is a certain proportion of new discoveries and details which relate to non-Peruvian forms, and whose discussion in a Peruvian report may be somewhat out of place; and finally, the fact that the preliminary presentation of these problems may result in opening discussions that will lead to additional information before the results must be summarized.

Consequently, it has been considered advisable to open a series of studies dealing particularly with Peruvian birds but containing accounts also of such new forms and facts as appear in the course of the work, whether from Peru or from other countries related to it in respect to the questions involved. The first of these papers is presented herewith.

Many thanks are due to Mr. Todd of the Carnegie Museum, Pittsburgh, for the loan of certain comparative material; also to Dr. C. E. Hellmayr for notes on certain European material not available to me. To Dr. A. Laubmann of Munich, I am greatly indebted for a careful comparison made between the type of *Malacoptila rufa* (Spix) and certain specimens sent to him for this examination.

Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

Malacoptila rufa brunnescens, new subspecies

TYPE from Caxiricatuba, Rio Tapajóz (right bank), Brazil, No. 248,846, American Museum of Natural History. Adult male collected May 13, 1931, by A. M. Olalla.

DIAGNOSIS.—Similar to *M. r. rufa* from the upper Amazon, northeastern Peru, and southeastern Ecuador, but head above much darker gray (blacker at tips of feathers) and much more strongly streaked with white shaft-lines; lores averaging paler rufescent, collar on hind neck averaging lighter rufous and more strongly contrasted with the back which is indistctly browner and less rufous; upper tail-coverts and tail less rufescent; white pectoral area bordered below by dusky margins which are often distinctly blacker and more sharply defined than in *rufus;* pale, pendant tuft at base of lower mandible more buffy, less whitish. Under wing-coverts paler, less ochraceous; males with inner margins of remiges whitish instead of buffy. Entire under parts (in typical birds), except the white pectoral patch, strongly tinged with grayish brown, less rufescent.

RANGE.—Amazonian valley on the south bank of the river between the right bank of the Rio Madeira (Borba) at least as far as the right bank of the Tapajóz. Whether or not the birds from the right bank of the upper Madeira (Jamarysinho, etc.) and the region from the Xingu to Pará are the same cannot be decided without additional material. Birds from between the Madeira and Purús rivers are intermediate between *brunnescens* and *rufa* but closer to *rufa;* those from between the Madeira and Tapajóz are also intermediate but closer to *brunnescens*

DESCRIPTION OF TYPE.—Large loral patch extending more narrowly across the forehead bright Tawny x Ochraceous-Tawny (pale at base of feathers); remainder of top of head and the auriculars Dark Mouse Gray, blacker at tips, with relatively broad, conspicuous shaft lines of white; malar region chestnut with pale shaft streaks, the rufous color continued unstreaked around the hind neck in the form of a well-defined collar somewhat paler than the malar region (Sanford's Brown x Burnt Sienna); from the base of the lower mandible a dependent tuft of pointed, stiffened feathers largely creamy buff; a more or less well-defined dusky stripe between this tuft and the rufous of the malar region; back dark Brussels Brown, well defined from the rufous collar; upper tail-coverts somewhat tawny only at tips. Chin pale buff with the feathers bristly, decomposed; upper throat Buffy Brown x Olive Brown, the feathers adjacent to the chin somewhat stiffened and decomposed and with pale shafts; those farther posterior more normal in structure and basally pure white; upper breast abruptly silky white with the lower feathers (and a few of the upper ones) sharply and conspicuously tipped with dusky, making a sharply-defined lower border to the white patch; lower breast Buffy Brown x Saccardo's Umber, somewhat more rufous laterally where it merges into the rufous malar stripe and the nuchal band; upper feathers of this area with a dusky subterminal band and white base which merge with the white breast patch and its dark horizontal bar; flanks buffy drab; belly and under tail-coverts Light Drab x Avellaneous, whitish subterminally. Wings blackish brown with exposed surface of upper coverts and tertials matching the back; outer margins of primaries and secondaries slightly paler than the back. Bend of wing and under wing-coverts Pinkish Buff; inner margin of quills Tilleul Buff. Rectrices above Sepia, faintly paler at tips; below paler with shafts conspicuously ochraceous. Maxilla and tip of mandible (in dried skins) blackish; base of mandible pale; feet pale brown. Wing, 91 mm.; tail, 67½; culmen from base, 30; exposed culmen, 24; tarsus, 18½.

REMARKS.—Sexes alike.

There is noticeable variation in certain details of coloration but none of the series can be confused with typical *rufa.* The brownish coloration of the back and the strongly streaked head are definitive.

A young bird from Serra de Parintins, collected November 12, 1930, and another from Tauarý, collected April 11, 1931, are much like the adults in general color and pattern except that the top of the head is buffy brown without any streaks (though the auriculars are streaked), the white pectoral patch is not fully developed and has the dusky line across its lower border only faintly suggested, and all colors are correspondingly duller except where adult plumage has commenced to appear.

Birds from between the Tapajóz and the Madeira are variously intermediate. Those from the immediate left bank of the Tapajóz are very like the right-bank specimens though inclined to be a little less grayish and more brightly rufescent below. Skins from a little farther west along the Amazon, opposite Obidos, are even brighter, while those from the right bank of the Madeira match *rufa* in ventral coloration except that the dark band across the lower portion of the white pectoral patch is quite blackish. In fact these latter skins largely combine the upper surface of *brunnescens* with the lower surface of *rufa* in such a regular way that it is a question whether the combination is not deserving of a distinctive name. However, one skin from Borba is inseparable from the typical series and, even without this complication, the range which would have to be assigned to such a form would be too restricted to be of much service in demonstrating the variations of the species as a whole. It is probably best to consider these as what they unquestionably are—exact intermediates between *rufa* and *brunnescens*.

As a matter of fact, the Borba and Villa Bella Imperatríz skins were recognized as being perfectly distinct from *rufa* and their description was in galley proofs when the Tapajóz material came to hand and demonstrated that additional characters were shown constantly by birds from the east bank of that river. Consequently the manuscript has been revised to show the later observations.

West of the Rio Madeira the tendency is still more in the direction of *rufa*, so much so that the birds from that side of the river must be referred to *rufa* though they are not typical. Specimens from Caviana and Rosarinho, between the Madeira and the Purús, show a variable tone of rufous and brown on the back, though the top of the head appears to be lightly streaked as in birds from Peru. The dark band between the white pectoral patch and the ochraceous-brown lower breast is variously sharply blackish as in *brunnescens* or paler and grayish as in *rufa*. The inner margins of the remiges of the males are as in *brunnescens*, being more whitish than ochraceous. On the whole, these birds seem to be closer to typical *rufa* and must be referred there for the present.

Hellmayr (1907, Novit. Zool., XIV, p. 400), notes that a female from Humaythá (left bank of the Madeira) has a deeper ferruginous frontal band and a more rufescent back than a specimen of the same sex from Pará. This is in accord with the general conclusions reached from the material before me which indicate the range of typical *rufa* as reaching from Peru to the left bank of the Madeira.

Although the existence of two forms of this species was discovered nearly a year ago when comparison was first made between specimens from Peru and the Rio Madeira, it was uncertain which form was typical *rufa* and which the new one. The Peruvian specimens agreed rather closely with Spix's plate and description, but Hellmayr, writing about the birds of the Rio Madeira, reported apparent agreement between Rio Madeira specimens and the type of *rufa*. Consequently it was necessary to submit specimens of both forms to Dr. A. Laubmann of Munich, with a request for a direct comparison with Spix's bird. This Dr. Laubmann kindly performed, reporting that the Peruvian bird agreed very well with the original while a specimen from Igaripé Auará, near Borba, represented the separable form.

Dr. Laubmann's report that the specimen sent him from Sarayacu, Peru, agrees closely with Spix's type as contrasted with a specimen from Igaripé Auara, near Borba, which represents the region from the lower Madeira to the Tapajóz, makes it evident that the bird Spix described came from the Rio Amazon somewhere above the mouth of the Madeira, probably west of the Purús, Specimens kindly loaned to me by Mr. Todd of the Carnegie Museum, Pittsburgh, show the characters of the typical form to be well marked in an example from São Paulo de Olivença, and as this was one of the localities visited by Spix, I hereby suggest it as restricted type locality of *M. r. rufa.*

Dr. Laubmann also wrote that specimens in Munich from Maruins and Alliança (to the right of the upper Madeira) and from Pará show the brown back of the new form but the sparsely streaked head of typical *rufa*. This throws some doubts on the probable distribution of *brunnescens*, which may be restricted, on the Madeira River, to the lower part of the right bank if *rufa* crosses the river in the upper portion to Alliança; more material from this latter region must be examined before this point can be determined. Snethlage (1914, Bol. Mus. Goeldi, VIII, p. 238), records the species from numerous localities between the east bank of the Tapajóz and the Pará region, and these may represent more than one form, judging by Dr. Laubmann's comment on his Pará specimen. This also will require the study of additional material. Snethlage's record from Cachoeira, Rio Purús, must belong to typical *rufa.*

Specimens Examined

M. r. rufa.—Peru: Sarayacu, Río Ucayali, 3♂, 1♀; Orosa, Río Amazon, 4 ♀. Ecuador: mouth of the Río Curaray, 1♂, 1♀. Brazil: Rosarinho, Rio Madeira (west bank), 1♂; Lago Sampaio, Rio Madeira (west bank), 1♂, 2♀; São Paulo de Olivença, 1♀[1]; Nova Olinda, Rio Purús, 1♂[1]; Arimã, Rio Purús, 1♂[1]; Caviana, 1♂[1].

M. r. brunnescens.—Brazil: Villa Bella Imperatríz, Lago Andirá, Rio Amazon, (south bank), 4♂, 5♀, 2 indet. sex; Villa Bella Imperatríz, Serra de Parintins, 1 juv. indet. sex; Igaripé Auará, Rio Madeira (east bank), 2♂, 1♀; Borba, 2♂; Caxiricatuba, Rio Tapajóz (right bank), 3♂ (incl. type), 2♀; Piquiatuba, 1♂; Tauarý, 1♀, 1 (?); Igaripé Brabo, Rio Tapajóz (left bank), 2♂, 2♀.

Conopophaga aurita australis Todd

Conopophaga aurita australis Todd, 1927, Proc. Biol. Soc. Wash., XL, p. 150, Dec. 2—Nova Olinda, Rio Purús, Brazil; ♂; Carnegie Museum.

Study of a series of fourteen specimens of this form has yielded somewhat unsatisfactory results. There is a great amount of variation in both sexes which is opposed to the relative uniformity exhibited by the other subspecies. The rufescence of the breast of the males is darkest in a specimen from Teffé, palest in one from São Paulo de Olivença, moderately pale in a Peruvian skin and another one from Teffé, and again darker in a specimen from Hyutanahán, Rio Purús. The top of the head is likewise variable in depth of rufescence. Two more males from Hyutanahán are quite different from the other male from that locality, having the black of the throat carried down over the upper breast as in *snethlageae*, except that the lower feathers are broadly tipped with the rufous of the lower breast which tends to conceal the black. There is also a slight reduction in the prominence of the dusky lunules on the mantle, also showing approach toward *snethlageae.* The belly, however, is paler than in either form.

The Peruvian male, at the western end of the range, has the rufescence of the breast somewhat more ochraceous in tone than the Brazilian birds, but the difference is not great in view of the variability shown by the latter.

The females are also puzzling. Hyutanahán and São Paulo females are variable within certain limits, but a bird of the same sex from Caviana has the breast very much paler than the others, Ochraceous-Tawny on the sides and almost Cinnamon-Buff on the lower part, with the belly whitish; the back is a little more olivaceous than it is in the other Brazilian females. The Peruvian female, however, is distinctly more olivaceous above and on the wings than even the Caviana specimen, though the color of the breast can be matched in Hyutanahân and São Paulo skins. The pileum is distinctly paler and duller than in any other example referred to *australis*, and therein may lie a recognizable difference.

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[1] Specimens in Carnegie Museum, Pittsburgh.

It is possible that the Caviana bird represents a white-bellied race to which the two aberrant Hyutanahân males show affinity, but I have not seen enough material to show this conclusively. It is also possible that the Peruvian birds can be separated as a relatively olivaceous form in which the female has a paler and duller crown, but until more material is available to show the constancy of these characters, in view of the variability shown elsewhere, I prefer to assign the Peruvian specimens to *australis* to which they bear much closer resemblance than to any other known subspecies.

SPECIMENS EXAMINED.—See under *C. a. inexpectata.*

Conopophaga aurita inexpectata, new subspecies

TYPE from Tabocal, Rio Negro, Brazil. No. 301,500, American Museum of Natural History. Adult male collected September 11, 1929, by the Olalla brothers.

DIAGNOSIS.—Nearest to *C. a. occidentalis* from eastern Ecuador, but upper parts rather brighter in coloration; top of head brighter rufescent (especially marked in the females), and back more ochraceous olive, less greenish olive. Compared to *C. a. aurita* from the Guianas and the north bank of the Amazon, east of the Rio Negro, the under parts are more buffy and with less white, and the top of the head is darker.

RANGE.—Tropical zone of Upper Amazonia, north of the Amazon, from the right bank of the Rio Negro west to the Putumayo and north at least to the Uaupés and the Caquetá (eastern Colombia).

DESCRIPTION OF TYPE.—Forehead, broad circumocular region, lores, auriculars, malar region, chin, and throat to anterior border of breast, black; a silvery white stripe of elongated feathers above auriculars from upper posterior margin of circumocular space to nape; top of head from behind forehead to nape bright Auburn; back between Dresden Brown and Saccardo's Umber; feathers of mid-back with well-marked blackish terminal borders preceded by an indistinct submarginal band of Tawny-Olive; blackish borders less conspicuous on upper mantle, rump, and upper tail-coverts. Breast Sanford's Brown x Cinnamon-Rufous, passing rather abruptly into light Cinnamon-Buff on the upper flanks and under tail-coverts, more olivaceous near thighs, which are Mummy Brown, and Pale Pinkish Buff on the mid-belly. Most of the upper wing-coverts Dresden Brown with a narrow dusky terminal margin and a pronounced submarginal lunule of bright Hazel or Amber Brown; tertials similar. Primary-coverts dull blackish with grayish olive outer margins. Alula with inner web dull blackish, inner half of outer web grayish olive, and outer web broadly white almost to tip; carpal edge of wing whitish; primaries and secondaries dusky with outer margins Dresden Brown. Under wing-coverts largely white with a buffy tinge at tip, but with a large patch of dusky near carpal edge of wing at base of primaries, surrounded by white; axillaries like flanks; inner margin of quills pale (Tilleul Buff). Tail sepia, outer margins somewhat brighter. Bill (dried skin) black; feet dull brownish. Wing, 67 mm.; tail, 28; exposed culmen, 12¼; culmen from base, 17¾; tarsus, 28.

REMARKS.—Females similar to males above except that forehead, lores, and superciliary line to the upper posterior border of the eye are white (anterior portions with hair-like tips black); throat pale and more ochraceous than the breast, chin even paler and inclined to whitish; anterior malar region dull, pale grayish-olive passing on the auriculars into a color intermediate between that of the breast and that of the crown.

Specimens Examined

C. a. aurita.—BRITISH GUIANA: Great Falls, Demarara River, 1 ♂; Supernaam, 1 ♀; Essequibo River 1 ♂ ; Rockstone, Essequibo River, 1 ♂. BRAZIL: Manáos, 1 ♂; Faró, Rio Jamundá, 1 ♂, 1 ♀.

C. a. occidentalis.—ECUADOR: lower Río Suno, 1 ♂; Río Suno, above Avila, 3 ♂, 2 ♀ ; below San José, 1 ♂, 1 ♀ ; mouth of the Río Curaray, 2 ♂, 1 ♀.

C. a. australis.—BRAZIL: Hyutanahán, 3 ♂, 3 ♀[1]; São Paulo de Olivença, 2 ♂, 1 ♀[1]; Santo Isidoro, Tefé, 1 ♂; ? Caviana, 1 ♀. PERU: mouth of Río Urubamba, 1 ♂; Lagarto, 1 ♀.

C. a. snethlageae.—BRAZIL: Miritituba, 2 ♂[1]; Villa Braga, 2 ♂, 4 ♂[1]; Aramanaý, Rio Tapajóz (right bank), 1 ♂; Caxiricatuba, 1 ♀, 1(?); Piquiatuba, 1 ♂, 2 ♀; Tauarý 1 ♂, 1 ♀.

C. a. inexpectata.—BRAZIL: Tabocal, Rio Negro, 1 ♂ (type), 2 ♀; Tatú, Rio Negro, 1 ♂; Tahuapunto, Rio Uaupés, 1 ♂, 1 ♀ ; Tonantins, 1 ♂[1]; Manacapurú, 3 ♂, 2 ♀.[1] COLOMBIA: Florencia, 1 ♂; La Murelia, 1 ♂.

Neoctantes niger (Pelzeln)

Xenops niger PELZELN, 1859, Sitzungsb. Akad. Wiss. Wien, Math.-naturw., Kl., XXXIV, p. 111—Marabitanas, Rio Negro, Brazil; Vienna Museum.

A single female from Puerto Indiana, at the mouth of the Napo, constitutes the first record of this bird from Peru. It agrees well with two females from Eucador (one from the Río Suno and one from the mouth of the Río Curaray, both affluents of the Río Napo), except that it is a trifle paler on the breast. Since none of the series is topotypical, no comparative notes can be given with typical birds.

Specimens Examined

N. niger.—ECUADOR: mouth of Río Curaray, 1 ♂, 1 ♀ ; Río Suno, above Avila, 2 ♂, 1 ♀ ; lower Río Suno, 1 ♂. PERU: Puerto Indiana, 1 ♀.

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[1] Specimens in Carnegie Museum, Pittsburgh.

Dichrozona cincta (Pelzeln)

Cyphorhinus (*Microcerculus*) *cinctus* PELZELN, 1868, 'Orn. Bras.,' I, pp. 47, 65—Borba, ♀; St. Joaquim, ♂; type locality desig. S. Joaquim (junction of Rio Uaupés and Rio Negro), Hellmayr, 1924; ♂; Vienna Museum.

A female of this rare and interesting species is at hand from Santa Rosa, upper Ucayali, Peru, the first specimen to be recorded from this country. For comparison there are seventeen additional skins from Ecuador, Colombia, extreme northwestern Brazil, the south bank of the Amazon opposite Obydos, and the east bank of the Rio Tapajóz.

The study of this material has been very instructive but leaves the affinity of the Peruvian bird an open question. Specimens from the upper Rio Negro and the Rio Uaupés (topotypical) are characterized by their rufescent coloration of the upper parts and the relatively small spotting of the breast. Colombian examples are very similar to the topotypes, differing only by slightly larger spots on the breast, but they are equally rufescent above.

On the other hand, three skins from Villa Bella Imperatríz, south of the Amazon, and four from the Tapajóz are noticeably paler and more ochraceous, less rufous, on the back, and the top of the head, though more rufous than the back, is lighter than in typical *cincta.* These birds are entitled to the name *D. c. zononota* Ridgway.

Ecuadorian specimens, as pointed out by Hellmayr (1903, Journ. Orn., LI, p. 536), are darker than typical *cincta*, but whereas Hellmayr believed this character to be due to the immaturity of the specimens he examined, a fully adult male from the Río Suno shows the same feature. Not only is the rufescent color of the head and back darkened and tinged with olive, but the feathers of the mantle have quite noticeable dusky tips. The under side is marked by relatively heavier black spots which even extend down the upper flanks (in somewhat reduced size); the lower flanks are darker and grayer, less ochraceous. Except for the extension of the black spots on the upper flanks, an adult female and a nearly adult male show the same characters. These birds are recognizably distinct from *cincta* and *zononota* and should be called *D. c. stellata* (Sclater and Salvin).

The Peruvian bird is decidedly nearest to typical *cincta* and without more material it would be impossible to point out any decided differences from that form since it seems to have no definite features that can not be matched in one or another of the *cincta* females. The spotting on the breast is a little heavier than in the Rio Uaupés female but like the La Murelia female which it matches best also in the color in the mantle, though it is a trifle less rufescent; it is, however, much more rufescent than either *stellata* or *zononota.*

With the range of this bird cut off from that of *cincta* by the region which *stellata* occupies, it seems very probable that there is a distinct but unrecognized form inhabiting eastern Peru, but it will require additional material to determine the point satisfactorily. Possibly Bolivian and west-Brazilian (Rio Juruá and Rio Purús) specimens belong to this same form. Birds have been recorded from these regions but no distinguishing characters have been given for them. They should at least show if *zononota* tends to become more rufescent as it extends westward from the Tapajóz and Madeira rivers.

SPECIMENS EXAMINED

D. c. cincta.—BRAZIL: Tatú, mouth of Rio Uaupés, 1♂; Tahuapunto, Rio Uaupés, 1♀; Yucabi, Rio Negro, 1♂; Monte Curycuryari, Rio Negro, 1♀. COLOMBIA: Florencia, Caquetá, 1♂, 1♀; La Murelia, 1♀.

D. c. zononota.—BRAZIL: Villa Bella Imperatríz, Lago Andirá (south bank of Amazon), 2♂, 1♀; Piquiatuba Rio Tapajóz, 2♂; Caxiricatuba, Rio Tapajóz. 1♂, 1♀.

D. c. stellata.—ECUADOR: lower Río Suno, 1♂, 1♀; below San José de Sumaco, 1♂.

D. c. subspecies.—PERU: Santa Rosa, upper Ucayali, 1♀.

Cercomacra serva hypomelaena Sclater

Cercomacra hypomelaena SCLATER, 1890, 'Cat. B. Brit. Mus.,' XV, p. 268—Cosnipata, S. E. Peru.

A careful study of 15 males (11 adult) and 3 females from Peru and Bolivia, and of 9 males (7 adult) and 5 females from Ecuador, has convinced me that Sclater's *hypomelaena* is entitled to recognition. The general characteristics of the Peruvian subspecies include a somewhat grayer, less blackish upper surface in the male sex, with the black of the under parts extending a lesser distance posteriorly, being followed by a somewhat paler tone of gray on flanks and belly. Females average a little brighter (less grayish) olive above and have the forehead more distinctly tinged with ochraceous in the middle. The wing and bill appear to average a trifle shorter. Wing, ♂, 62–67.5 mm. (av. 64.9); ♀, 60–64.5 (av. 61.2); culmen from base, ♂, 18–19.5 (av. 19); ♀, 17.5–18 (av. 17.7). In *serva* the measurements are: wing, ♂, 64.5–70 (av. 66.6); ♀, 60–64 (av. 61.6); culmen from base, ♂, 17.5–20.5 (av. 19.2); ♀, 17.5–19 (av. 18.7).

So far as the present series shows, there is no overlapping of characters in the males. The palest *serva* is certainly very close to the darkest *hypomelaena*, but if the breast is equally black in the two examples, the flanks and the upper surface are distinctive. In series, the differences are quite pronounced.

In the female sex there is not the same constant demarcation, but the characters mentioned, especially the color of the forehead, may serve to differentiate the two forms in small series. The extremes are noticeably distinct.

Hellmayr [1920, Arch. Naturg., LXXXV, A, (10), p. 104] compares three topotypical males of *serva* from the Napo region, Ecuador, with five males from the Carabaya district of Peru without finding recognizable differences to validate *hypomelaena*, but the details of his observations distinctly agree with the characterization I have given above. One Napo male and one from San Gaban, Carabaya, were found to be equally dark; two other Napo males were distinctly darker, and the rest of the Carabaya males were paler. Measurements also showed longer wing and bill in Ecuadorian specimens.

A male in Field Museum of Natural History, referred by me to *serva* (1930, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 331), was noted as having the lower breast more grayish than the sooty black of the upper breast, a characterization which agrees with *hypomelaena* although no direct comparison has been made with the present series.

In the light of this evidence I see no reason to refuse recognition to *hypomelaena* as a valid race. Whether the birds recorded from Pebas belong here or to typical *serva* remains to be determined. Probably they belong to *serva*.

A young male from the Urubamba Valley, recorded by Chapman as *nigrescens approximans* and transferred by Hellmayr to *serva*, appears to belong best in the *nigrescens* group, though it is in abnormal plumage and can not be matched in either series. Curiously, *serva* was not obtained on the right bank of the upper Ucayali nor was *C. nigrescens fuscicauda* taken on the left bank, though both were secured at Orosa on the Amazon below the mouth of the Ucayali.

SPECIMENS EXAMINED

C. s. serva.—ECUADOR: Río Suno above Avila, 4♂, 1♀; lower Río Suno, 2♂, 2♀; below San José de Sumaco, 3♂, 1♀; mouth of Río Curaray, 4♂, 1♀.

C. s. hypomelaena.—PERU: Rio Tavara, 5♂, 2♀; La Pampa, 4♂; Astillero, 1♂; Santa Rosa, upper Ucayali, 3♂, 1♀; Orosa, Río Amazon (south bank), 1♂; Puerto Bermúdez, 1♂, 1♀.[1] BOLIVIA: Reyes, 1♂.

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[1] Specimens in Field Museum of Natural History, Chicago

Cercomacra nigrescens fuscicauda, new subspecies

TYPE from Lagarto, upper Rio Ucayali, Peru. No. 239,140, American Museum of Natural History. Adult female collected March 25, 1928, by the Olalla brothers.

DIAGNOSIS.—Closest to typical *C. n. nigrescens*. Males slightly lighter in color but averaging darker than *C. n. approximans*. Females readily distinguishable from both forms mentioned by having the forehead, lores, and superciliary region noticeably less strongly rufescent but the crown and occiput more tawny, less contrasted with the forehead. Back brighter than in *nigrescens* but browner and darker, less olivaceous, than in *approximans;* under parts possibly averaging brighter; concealed white patch on mantle smaller; tail distinctly darker (blacker) and less broadly margined with olivaceous than in *approximans*, about as in *nigrescens*.

RANGE.—Eastern Peru, mainly in the Ucayali Valley, but apparently crossing the Amazon below Iquitos to the mouth of the Napo and possibly to Pebas; extending southeastward through the Urubamba Valley and reaching northwestern Bolivia.

DESCRIPTION OF TYPE.—Top of head bright Dresden Brown x Antique Brown; forehead, lores, and superciliary region somewhat brighter, suffused with Mars Yellow x Amber Brown (not as strongly bright rufescent as in *approximans*); mantle a trifle more olivaceous than Dresden Brown with a small concealed patch of silky white on the lower portion; rump Brownish Olive. Sides of face Mars Yellow x Amber Brown; auriculars with a trace of olive at the tips; chin and throat a little lighter than the sides of the face; breast, sides and middle of belly like the malar region; flanks like the rump; under tail-coverts a little more buffy. Remiges light Clove Brown, margined exteriorly with Saccardo's Umber; upper wing-coverts more sooty, with light Dresden Brown tips; bend of wing and under wing-coverts brighter, like the throat; axillars a little paler; inner margins of remiges whitish except distally. Tail blackish; base of lateral margins above somewhat olivaceous like the upper tail-coverts. Wing, 64 mm.; tail, 57; exposed culmen, 15; culmen from base, 20; tarsus, 23.

REMARKS.—Males are Dark Neutral Gray, rather blacker on the mantle; the concealed patch of white on the dorsum is usually small as is the white patch on the shoulder.

There is a faint "bluish" bloom on the adult males except one from Orosa which is duller and more sooty. This bird greatly resembles *C. serva hypomelaena* in various ways but it is not quite black enough and has too large a bill. A young male and a female from the same locality unquestionably belong to the present species. All three Orosa birds have unusually heavy bills which are not matched in any of the series except possibly in a young male from Puerto Indiana at the mouth of the Napo. This last-named bird is referred here because of its similarity to the Orosa male in the size of bill and color of the adult feathers which have appeared, as well as of the immature feathers not yet lost.

Bolivian examples seem to be referable to this new form rather than to *C. n. approximans* (from Matto Grosso). An adult male from Mapiri is more or less intermediate, but the female and a young male from Todos Santos have the characters of *fuscicauda*.

The similarity of this subspecies to typical *nigrescens* rather than to its nearest geographical affinities is curious. As a matter of fact, the known distribution of the entire species seems to be distinctly interrupted and the gaps filled by the presence of the very similar *tyrannina* group, with no apparent conflict. Although both *tyrannina* and *nigrescens* are at hand from Faró, it appears from remarks by Snethlage (1913, Journ. Orn., LXI, p. 529) that they do not occur precisely together, *approximans* inhabiting the "varzea" or periodically inundated area, and *tyrannina* the drier forests and clearings. It is thus possible that these two groups ought to be united, but there are certain more or less well-defined characteristics which separate them in spite of apparent resemblances. At any rate, I am not prepared to place them in the same species. As represented at Faró, the groups are recognizably distinct in both sexes.

The Faró specimens, listed below under *C. n. approximans*, are somewhat equivocal subspecifically. While they unquestionably belong to the *nigrescens* group, two of the males could be referred to typical *nigrescens* as readily as to *approximans*, but a third male agrees best with *approximans* as does a single female.

Specimens Examined

C. n. nigrescens.—French Guiana: Approuague, 2♂, 2♀; Paramaribo, 2♂.

C. n. approximans.—Brazil: Boim, Rio Tapajóz, 1♂, 1♀; Borba, 7♂, 5♀; Igaripé Auará, Rio Madeira, 2♂, 2♀; Villa Bella Imperatríz, south bank of Amazon, 3♂, 3♀. Serra de Parintins, 1♂, 1♀; Boca de Rio Andirá, 1♂, 1♀; Santa Clara, 6♂, 10♀. Faró, north bank of Amazon, 3♂, 1♀; Siete de Septembre, Matto Grosso, 1♀.

C. n. fuscicauda.—Peru: Lagarto, upper Ucayali, 5♂, 7♀ (incl. type); mouth of Río Urubamba, 1♂; San Fernando, Río San Miguel, 1♂; Orosa, 2♂, 1♀; Puerto Indiana, north bank of Río Amazon, 1♂. Bolivia: Mapiri, 1♂; Todos Santos, 1♂; mouth of Río San Antonio, Río Espirito Santo, 1♀.

C. n. notata.—Peru: Tulumayo, Junín, 2♂, 3♀ (incl. type); Uschco, 1♂, 2♀; Vista Alegre, Río Chinchao, 2♂, 3♀[1]; Poco Tambo, near Rioja, 1♀[1]; Chinchao, 1♀[1]; La Merced, 1♂, 1♀.[1]

C. n. aequatorialis.—Ecuador: lower Sumaco, 1♂, 1♀ (incl. type); Chaco, lower Oyacachi, 5♂, 5♀; Guayaba, 1♂, 1♀; Sabanilla, 1♂; Macas region, 1♂.

Cercomacra nigrescens notata, new subspecies

Type from Tulumayo, Junín, Peru. No. 169,713, American Museum of Natural History. Adult female collected May 26, 1921, by H. Watkins.

Diagnosis.—Females distinguishable from the other subspecies of *nigrescens* except *aequatorialis* by the decidedly paler tail; from *aequatorialis*, distinguishable by characters given under that form. Males not clearly distinct from those of the other forms but averaging paler below than *fuscicauda*; with certain average differences from *aequatorialis* as given under that subspecies.

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[1] Specimens in Field Museum of Natural History.

RANGE.—Central valleys of Peru from Chanchamayo and Junín to the Río Huallaga and its tributaries.

DESCRIPTION OF TYPE.—Forehead, lores and a superciliary stripe bright Mars Yellow x Amber Brown; crown and occiput dark Saccardo's Olive; mantle light Brownish Olive; rump and upper tail-coverts a little paler and tinged with buffy; a small, concealed patch of white on the lower mantle; auriculars like the lores but with a slightly brownish area posteriorly. Under parts Mars Yellow x Amber Brown; lower flanks Dresden Brown; under tail-coverts a little paler and duller than the belly. Remiges Hair Brown x Chaetura Drab with exterior margins light Dresden Brown, paler at base of outer two pairs; upper wing-coverts darker than the remiges, with external and terminal margins bright Sudan Brown; outer margin of alula paler, more ochraceous, and under wing-coverts and axillars similar; inner margins of remiges pale buffy. Tail Olive Brown with narrow external margins of brighter olive. Maxilla black; mandible whitish; feet slaty black (in dried skin). Wing, 64 mm.; tail, 62; exposed culmen, 16; culmen from base, 20; tarsus, 24½.

REMARKS.—Males below are Deep Neutral Gray; above nearly Dark Neutral Gray, with mantle rather blacker and concealed white patch well developed; under wing-coverts gray with little or no white at the base of the primaries; inner margins of remiges pale but not exactly whitish; upper wing-coverts with not very conspicuous white tips, sometimes lacking on greater series. One Uschco[1] female and one (in Field Museum) from Poco Tambo show an approach toward *aequatorialis*.

SPECIMENS EXAMINED.—See under *C. n. fuscicauda*.

Cercomacra nigrescens aequatorialis, new subspecies

TYPE from the lower Sumaco, eastern Ecuador. No. 184,517, American Museum of Natural History. Adult female collected January 9, 1926, by the Olalla brothers.

DIAGNOSIS.—Nearest to *C. n. notata* with which the females agree in having the tail light brownish rather than fuscous, but from which they differ in the more rufescent, less olivaceous upper parts; back distinctly brighter than in *fuscicauda*; forehead about as in *notata* but crown and occiput more rufescent. Males possibly a trifle darker than those of *notata*; upper wing-coverts with more white; under wing-coverts with a larger extent of white at the base of the quills.

RANGE.—Eastern Ecuador.

DESCRIPTION OF TYPE.—Forehead bright Amber Brown (x Xanthine Orange), lores and a superciliary stripe a little brighter; mantle Brussels Brown x Dresden Brown; rump and upper tail-coverts a little brighter and more tawny; auriculars like the forehead with a brownish tinge at the tips. Under parts about like the lores;

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[1] I am not satisfied with this spelling which does not seem to parallel that of any other Peruvian locality. Possibly it should be "Uchco" or "Ushco." The place is situated on the road from Chachapoyas to Moyobamba, about seven miles below Almirante, and was visited by Harry Watkins, whose spelling of the name is given herewith.

flanks dark Dresden Brown. Remiges Hair Brown x Chaetura Drab, with exterior margins light Cinnamon Brown; upper wing-coverts somewhat darker than the remiges, with margins and tips bright Sudan Brown; under wing-coverts Ochraceous-Orange x Ochraceous-Tawny; inner margins of remiges pale whitish buff. Tail dark Olive Brown with brighter margins at base. Maxilla black; mandible whitish; feet dark slaty brown (in dried skins). Wing, 67 mm.; tail, 64; exposed culmen, 15½; culmen from base, 19½; tarsus, 24.

REMARKS.—Males above are Dark to Dusky Neutral Gray with a (usually large) concealed white patch on the mantle; rump and upper tail-coverts somewhat paler than the back. Under parts Deep Neutral Gray; crissum sometimes tinged with olivaceous. Concealed white patch on shoulder large; upper wing-coverts with broad white tips; under wing-coverts with a distinct white patch at the base of the primaries (a male from Sabanilla with most of the under wing-coverts white); inner margins of remiges white or whitish; retrices with narrow but distinct white tips. Bill black; feet dull black.

As mentioned under *C. n. notata,* a female from Uschco and one from Poco Tambo, Peru, show an approach toward *aequatorialis*, being somewhat more rufescent above than the other Peruvian examples of *notata.* Two females from the lower Río Oyacachi show a tendency toward *notata* in the slightly more olivaceous tone of the upper parts but they are still clearly referable to *aequatorialis.* A young male from Puerto Indiana, Peru, at the mouth of the Napo, might possibly belong here also, but it seems to show better affinities to *fuscicauda* from the opposite bank of the Amazon, and I have referred it to that form for the present. Females from that region will be needed to decide the question.

SPECIMENS EXAMINED.—See under *C. n. fuscicauda.*

Schistocichla schistacea (Sclater)

Hypocnemis schistacea SCLATER, 1858, P. Z. S. London, XXVI, p. 252—Río Javarri, northeastern Peru; ♂; British Museum.

The discovery, among the Peruvian material, of a female of *S. leucostigma subplumbea,* once considered to be a subspecies of the present form, from Orosa whence there are two females of unquestioned *schistacea* also present, and the finding of a male of *schistacea* from Apiyacu, on the north bank of the Amazon not far from Puerto Indiana whence there are undoubted specimens of *subplumbea,* has raised considerable doubt as to the specific unity of these two forms. An additional male from Sarayacu, lower Ucayali, has made the series of *schistacea* complete enough to permit a careful study of the relationship of that form with *subplumbea* and its allies which has resulted in the conclusion that two species are, after all, to be recognized. The females are, as is now known, quite different in the coloration of the upper parts and the wings, though the under surface is strikingly similar. Above, however, *schistacea* females have the head quite rufescent with strongly marked shaft-lines of pale cinnamomeous, while the upper mantle has similarly obvious pale shaft-lines, and the side of the head, including a narrow line above the eye, is brighter than the crown though deeper than the breast. The shafts of the entire plumage tend to be pronounced in both sexes. The male is colored almost exactly like that of *S. leucostigma intensa* (*S. subplumbea intensa* and *S. schistacea intensa* auctorum) though a little darker below, but there is a bluish sheen to the feathers that is lacking in *intensa*, and the plumage is somewhat more compact. Further than this, in both sexes the bill of *schistacea* is shorter and more slender, with a straighter culmen and with the nostrils nearer the tip; the nostrils themselves are rounder, less elongate, and with a slightly more appreciable space between the hinder margin and the first feathering. In the male, the bill is solidly black. The feet are smaller, with shorter claws. At the carpal edge of the wing, the pale spots on the upper wing-coverts (white in the male, pale rufous in the female), which are more or less reduced in *intensa*, are here enlarged and elongated sufficiently to make a noticeable broad stripe. Feet black in both sexes.

Under other circumstances, these characters are no more than might be considered of subspecific value. A female of *S. l. rufifacies* has a pale rufescent line around the eye and the feathers of the forehead and anterior auriculars have rather prominent shafts and are tinged with ochraceous, while the wings are dark, the flanks are shaded with dark olive, and the upper tail-coverts are darker than the back. In all these particulars, there is a tendency toward the characters of *schistacea*. A female *S. l. saturata* similarly has prominent shafts on the top of the head and auriculars (though these areas are gray) and the flanks are very similar in coloration to those of *schistacea*, while the feet are equally blackish and the bill equally dark. In these ways there are shown certain similarities which may be useful in suggesting a relatively recent common origin if they do not signify a parallelism in development. Nevertheless, the most nearly unbroken line of present-day relationship connects the *leucostigma* and *subplumbea* groups and leaves *schistacea* as an apparently closely related but specifically distinct form which occurs at certain places together with members of the larger group.

SPECIMENS EXAMINED.—See under *S. leucostigma brunneiceps*.

Schistocichla leucostigma subplumbea (Sclater and Salvin)

Dysithamnus subplumbeus? SCLATER AND SALVIN, 1880, P. Z. S. London, p. 158—Sarayacu, Ecuador; British Museum.

A series from Pomará, south bank of the Río Marañón, Río Seco, west of Moyobamba (also south of the Marañón), Huarandosa, Río Chinchipe, and Puerto Indiana, mouth of the Napo, present fairly uniform characteristics of *subplumbea*. This is not surprising in view of the affinity, which is becoming increasingly evident, between eastern Ecuador and the Chinchipe-Pomará region of Peru. The surprising discovery is that a female from Orosa, south bank of the Amazon, opposite a point below the mouth of the Napo, belongs to this same form and not to *intensa* which inhabits the upper Ucayali (including Chanchamayo) and upper Huallaga valleys but evidently does not descend either of them any great distance. The Amazon apparently is not a distributional barrier in the case of this form, which crosses the river at this point as does *S. schistacea*.

There is considerable variation in the depth of the rufous coloration on the under parts of the females and some also in the coloration of the upper parts, but the series remains distinct from *intensa* by being less blackish on the head and less deeply rufescent on the back. The males are paler gray throughout.

In view of this demonstrated distribution, I am inclined to place Bartlett's Xeveros specimen (SCLATER, 1890, 'Cat. Birds Brit. Mus.,' XV, p. 276, Spec. k) in the present form. Iquitos birds unquestionably belong here.

SPECIMENS EXAMINED.—See under *S. l. brunneiceps*.

Schistocichla leucostigma intensa (Zimmer)

Myrmeciza schistacea intensa ZIMMER, 1927, Proc. Biol. Soc. Wash., XL, p. 208—Huachipa (junction of the Chinchao and Huallaga rivers), Peru; ♀; Field Museum of Natural History.

Specimens from Santa Rosa, upper Ucayali, and Tulumayo, Junín, are referable to the dark-backed, blackish-headed subspecies of the upper Huallaga. The Junín examples have been recorded before in the original description; the occurrence of the subspecies on the main stream of the Ucayali has not been noted heretofore. Apparently the bird does not descend the stream since it has not been found at Sarayacu, while at Orosa, on the Amazon below Iquitos, the allied subspecies *subplumbea* represents it.

SPECIMENS EXAMINED.—See under *S. l. brunneiceps*.

Schistocichla leucostigma brunneiceps, new subspecies

Type from Chaquimayo, Andes of Carabaya, southeastern Peru; altitude 3000 feet. No. 16,349, Zoologische Staatssammlung, Munich. Adult male collected July 7, 1910, by H. and C. Watkins. Original number 273.

Diagnosis.—Intermediate between *S. l. humaythae* from the left bank of the lower Rio Madeira, Brazil, and *S. l. intensa* from eastern Peru. Female darker than *humaythae* and paler than *intensa*, with the top and sides of the head washed with brown, not sharply defined from the back as in *intensa*. Males nearest to *intensa;* darker than *humaythae*. Feet and bill apparently intermediate in color, darker than in *humaythae* but somewhat paler than in *intensa*.

Range.—Carabaya district of southeastern Peru. Known from Chaquimayo, La Pampa, and Marcapata.

Description of Type.—Back Prouts Brown; top of head Mummy Brown, not sharply defined from the back; sides of head dark Dresden Brown. Under parts largely Amber Brown; throat a little paler; sides of breast darker, merging into the color of the back; flanks and under tail-coverts Brussels Brown x Raw Umber; under wing-coverts Sudan Brown; under wing-coverts and remiges dark Natal Brown, the coverts with a terminal spot of tawny. Retrices dusky Neutral Gray with faintly browner edges. Wing, 71 mm.; tail, 56; exposed culmen 18; culmen from base, 21½; tarsus, 27.

Remarks.—The male is not fully grown but has acquired enough of the adult plumage to show the probable characters of this sex. The crown is Dark Neutral Gray, the back Deep Neutral Gray. Throat Neutral Gray (with a tinge of Mouse Gray due to immaturity); breast between Neutral and Deep Neutral Gray; belly similar with some narrow tips of white; flanks like breast (with some deep rufous feathers of immaturity still persisting). Remiges and upper wing-coverts blackish (immature feathers fuscous), coverts with terminal spots of white (some buffy). Tail sooty blackish. Maxilla blackish; mandible dusky but with an irregular area on lower portion somewhat whitish; feet dark brown (in dried skin). Wing, 67 mm.; tail, 52½; exposed culmen, 17¼; culmen from base, 22; tarsus, 27.

The existence of this subspecies has long been known but the absence of males in adult plumage has prevented the accurate study of the relationships of the form in question. The material at hand has now made this study possible.

It is evident from the characters given above that the form here described is intermediate between *S. l. humaythae* from the left bank of the Rio Madeira (and the upper regions on the right bank: Alliança, etc.) and the bird I described as *Myrmeciza schistacea intensa*. The supposed specific affinity of *schistacea* and *subplumbea* and the discovery of both *schistacea* and a member of the *leucostigma* group at Tonantins by Mr. Todd (1927, Proc. Biol. Soc. Wash., XL, p. 166) has led to the assumption that *subplumbea* and *leucostigma* must be specifically distinct [Hellmayr, 1929, Journ. Orn., LXXVII, (2), Festschrift, p. 59]. However, both *schistacea* and a member of the *subplumbea* group (*intensa*) are now known to occur together in northern Peru as I have shown above in the discussion of *schistacea*, so that, with *schistacea* thus necessarily removed from the *subplumbea* group, the apparent conflict in the ranges of *leucostigma* and *subplumbea* is now removed. The intermediacy shown by the present new form is sufficient evidence that *subplumbea* must be reduced to a secondary place under the older name *leucostigma*.

In the matter of the color of the feet in *humaythae*, although the fact is not mentioned in published accounts, all our specimens show the feet to be distinctly browner and darker than in *rufifacies*, though not so blackish as in *subplumbea*, *intensa*, and *saturata*; *infuscata*, which I have not seen, is said to have the light feet of *leucostigma* but our two skins of *leucostigma* have the feet darker than in *rufifacies*. The new form described herewith has the feet darker than *humaythae* but paler than *infuscata*, as mentioned in the diagnosis.

Specimens Examined

S. l. leucostigma.—British Guiana: Tumatumari, Potaro River, 2♂, 2♀; Rockstone, Essequibo River, 1♀; Carimang River, 1♂.[1] Brazil: Conceição, Rio Branco, 1♀ (?).[1]

S. l. rufifacies.—Brazil: Villa Bella Imperatríz, Serra de Parintins, 1♂, 1♀; Urupa, Rio Gy-Paraná, 1♂.

S. l. humaythae.—Brazil: Rosarinho, Lago Sampaio, 2♂, 2♀; Rio Picto, 1♂.

S. l. brunneiceps.—Peru: Chaquimayo, Andes of Carabaya, 1♀ (type)[2]; La Pampa, 1♂.

S. l. intensa.—Peru: Tulumayo, Junín, 1♂, 1♀; Santa Rosa, upper Ucayali, 1♂, 2♀; Vista Alegre, 1♂[1]; Huachipa, 2♂, 1♀ (type).[1]

S. l. subplumbea.—Colombia: La Murelia, Caquetá, 1♂, 2♀; Florencia, 2♀. Ecuador: Río Suno, above Avila, 4♂, 3♀; lower Río Suno, 2♂, 2♀; mouth of Río Curaray, 1♂; below San José, 1♂. Peru: Puerto Indiana, mouth of the Napo, 2♂; Orosa, south bank of Río Amazon, 1♀; Huarandosa, Río Chinchipe, 2♂, 3♀, 1?; Pomará, Río Marañón, 1♂, 1♀; Río Seco, about 30 miles west of Moyobamba, 1♂, 1♀.

S. l. saturata.—Venezuela: Arabupu, Roraima, 4200 ft., 1♀.

S. schistacea.—Peru: Sarayacu, Río Ucayali, 1♂; Apiyacu, north bank of Amazon, 1♂; Orosa, south bank of Amazon, 2♀; Brazil. São Paulo de Olivença, 3♂, 2♀[3]; Tonantins, 4♂.[3]

Formicarius analis analis D'Orbigny and Lafresnaye)

Myothera analis D'Orbigny and Lafresnaye, 1837, Mag. Zool., VII, cl. 2, p. 14—Yuracares and Chiquitos, Bolivia.

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[1] Specimens in Field Museum of Natural History, Chicago.
[2] Specimen in Zoologische Staatssammlung, Munich.
[3] Specimens in Carnegie Museum, Pittsburgh.

A female from La Pampa, Río Tavara, Peru, agrees quite closely with nearly topotypical Bolivian specimens and undoubtedly represents typical *analis*. Other specimens from the Ucayali River and the south bank of the Amazon below Iquitos are somewhat less distinctly tinged with rufescence than the skin from La Pampa, though some of them are matched by one of the less rufescent Bolivian birds. A good series from the Rio Madeira in Brazil shows both extremes. All agree in having moderately light-colored mantle and head, pale rufescent crissum and upper tail-coverts, pale belly, and dull breast. For the present, I consider them all as belonging to *F. a. analis*.

SPECIMENS EXAMINED.—See *F. a. olivaceus*.

Formicarius analis zamorae Chapman

Formicarius analis zamorae CHAPMAN, 1923, Amer. Mus. Novit., No. 96, p. 9—Zamora, eastern Ecuador; ♂; Amer. Mus. Nat. Hist.

Birds from Pebas, Puerto Indiana, and Apiyacu, on the north bank of the Amazon, agree quite closely with the type of *zamorae* and a series from the Río Suno, eastern Ecuador. Records from Iquitos doubtless also belong here though I have seen no material from that immediate locality.

Specimens from the Río Chinchipe, north of the Marañón, considerably farther west than Iquitos, appear to be recognizably distinct and to share their characters with the birds from south of the river in the same general longitude, being also distinct from the Ucayali birds. They are accordingly described below.

SPECIMENS EXAMINED.—See under *F. a. olivaceus*.

Formicarius analis olivaceus, new subspecies

TYPE from Huarandosa, valley of the Río Chinchipe, northwestern Peru; elevation 3000 ft. No. 182,045, American Museum of Natural History. Adult male collected September 19, 1923, by Harry Watkins. Original number 7891.

DIAGNOSIS.—Nearest to *F. a. zamorae* from eastern Ecuador and northeastern Peru, north of the Amazon, but differs by having the upper parts darker and more olivaceous, less rufescent; the rump duller, less rufescent; the black of the throat occupying a shorter, more restricted area and deeper, less brownish; the gray of the breast clearer, more of a carbon-gray; belly and flanks grayer, less brownish. Compared with *F. a. analis* of the Rio Madeira and eastern Peru, the upper and under parts are decidedly darker; the rump less rufescent; the rufous of the crissum usually deeper; the black of the throat usually more restricted; the white loral spot averaging distinctly smaller, never as large as in some *analis;* bill shorter, 20¼-23 mm. as against 22-25 in *analis*.

RANGE.—Northwestern Peru in the valleys of the tributaries of the Marañón and the lower Huallaga (Río Chinchipe and Río Mayo); humid tropical zone.

Description of Type.—Top of head basally fuscous black with terminal borders of dark Brownish Olive, lighter on the forehead. Back dark Raw Umber x Medal Bronze, becoming more rufescent posteriorly; rump nearest Raw Umber; upper tail-coverts Argus Brown. Lores and a slight backward extension to the supra-anterior corner of the orbit black with a small triangular spot of white in the middle. Chin, throat and sides of face black; upper posterior auriculars olive grayish. Breast Dark Dull Gray x Neutral Gray, becoming dark olive-brown on sides; flanks Brownish Olive; abdomen Pale Smoke Gray tinged with buff; under tail-coverts bright Hazel. Outer surface of wings like the back except on outer primaries and primary-coverts, which are black, and outer web of alula, which is paler olive. Axillaries and under wing-coverts orange-buff with black tips; inner webs of wings crossed by a band of Cinnamon-Buff. Retrices with terminal half black; basal half faintly tinged with brown. Wing, 95 mm.; tail, 54½; exposed culmen, 17½; culmen from base, 22; tarsus, 31.

Remarks.—Females similar to the males. Some specimens are distinctly lighter olivaceous above than the type; others have the outer surface of the wings slightly more rufescent than the back; one male from Río Seco has the crissum deeper in coloration while two topotypical females have it somewhat lighter; the belly is pale buffy in a male from the Río Seco; and several skins of both sexes and from both localities show traces of rufescence on the sides of the neck. The diagnostic characters, nevertheless, remain distinctive in the series at hand.

Probably the specimens recorded by various authors from Chyavetas, Xeberos, Shanusi (Yurimaguas), and Huambo belong to this same form.

Specimens Examined

F. a. analis.—Bolivia: Yungas, 1 (?); San Antonio, Río Chimoré, 1 ♂; Jatumpampa, 1 ♂; Todos Santos, 1 ♀. Brazil: Barão Melgaço, Matto Grosso, 1 ♂; Borba, 3 ♀; Auarí, Rio Madeira, 7 ♂, 2 ♀; Rosarinho, 2 ♂, 1 ♀; Villa Bella Imperatríz, 5 ♂, 1 ♀. Peru: Orosa, 1 ♂, 1 ♀; Sarayacu, 1 ♂; Santa Rosa, Ucayali, 1 ♀; Lagarto, 3 ♂, 3 ♀; mouth of Río Urubamba, 2 ♂, 1 ♀; La Pampa, 1 ♀.

F. a. zamorae.—Ecuador: Zamora, 1 ♂ (type), 1 ♀; mouth of Río Curaray, 3 ♂, 2 ♀; Río Suno above Avila, 3 ♂, 2 ♀; lower Río Suno, 1 ♀; below San José, 3 ♂, 2 ♂. Peru: Pebas, 1 ♂; Puerto Indiana, 1 ♂, 1 ♀; Apiyacu, 3 ♂.

F. a. connectens.—Colombia: Villavicencio, 2 ♂ (including type); La Murelia, 1 ♂, 2 ♀.

F. a. olivaceus.—Peru: Huarandosa, Río Chinchipe, 2 ♂ (including type), 2 ♀; Río Seco, 30 miles west of Moyobamba, 3 ♂, 1 ♀.

Melanopareia maranonica Chapman

Melanopareia maranonicus Chapman, 1924, Amer. Mus. Novit., No. 123, p. 3, July 2—Perico, Río Chinchipe; ♂; Amer. Mus. Nat. Hist.

This very distinct form is, as described, somewhat intermediate between the *elegans* group and the *maximiliani* group, though nearer to *elegans*. However, it has certain characters of its own which are not intermediate, the most striking of which is found in the pure white outer margins of the greater and middle upper wing-coverts, and there is no indication of suggested transition in any of the material at hand. Possibly at some future date the diverse members of the genus may be united into a single species with less interruption in the range than is now known, but at present I prefer to recognize three and keep the present form intact.

SPECIMENS EXAMINED.—See under *M. elegans paucalensis*.

Melanopareia elegans paucalensis (Taczanowski)

Synallaxis paucalensis TACZANOWSKI, 1884, 'Orn. Pérou,' II, p. 131—Paucal; collection Raimondi (Lima); ♂ (in alcohol).

I am inclined to believe that this subspecies is just recognizable. The black cap of the males seems to be continued farther over the anterior margin of the mantle than in Ecuadorian birds; the black averages grayer, less brownish; the lower breast and belly average lighter Bay or Chestnut, being sometimes distinctly lighter and never as dark as the darkest *elegans;* the black pectoral band averages narrower; and the superciliary line averages less deeply buff. Peruvian females have the top of the head lighter with paler edges and with much less distinct demarcation from the back, sometimes with nearly complete transition.

Certain examples from Puna Island and Chone, Ecuador, are noticeably paler below and on the wing-coverts than typical *elegans* and represent the form described as *speciosa,* if that race is separable; but the females have the top of the head as dark as in typical *elegans* and show no approach toward the characters of *paucalensis*.

SPECIMENS EXAMINED

M. e. elegans.—ECUADOR: Punta Santa Ana, 1♂; Portovelo, 1♂, 1♀; Río Pindo, 2♂, 2♀; Chone, Manavi, 2♀; Isla de Puna (? =*speciosa*), 2♂, 1♀.

M. e. paucalensis.—PERU: Palambla, Piura, 5♂, 2♀; Trujillo, 2♂, 2♀.

M. maranonica.—PERU: Perico, Río Chinchipe, 4♂ (incl. type), 2♀; Jaen, Marañón Valley, 1♂.

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PHYLOGENY OF THE HETEROMYID RODENTS

By Albert Elmer Wood

The Family Heteromyidæ includes a number of recent forms from North America, and several fossil forms, from the continental Tertiary beds of the western United States, ranging from the Oligocene to the Pliocene. The group has been rather neglected by palæontologists, due, probably, to the rarity of the fossil forms, and to their small size, the former probably being a function of the latter. A collection of rodents from the Deep River beds of Montana, which was recently turned over to me for study by Dr. C. C. Mook, contains an undescribed heteromyid which forms an important link between the earlier and the later members of the family.

I am greatly indebted to Dr. C. C. Mook for allowing me to study his collection, as well as to The American Museum of Natural History for affording me the facilities to do the work. Dr. Horace Elmer Wood, II, has given me much constructive criticism during the course of the work. I wish to express my gratitude to Dr. Florence Dowden Wood, who has made all the drawings in this paper. I am indebted to Dr. R. S. Lull and Dr. M. R. Thorpe for permission to study the specimen of "*Diplolophus*" *parvus* in the Yale Museum. Mr. R. H. Hatt of the American Museum has lent me representatives of the modern forms for comparison with the fossils, and has also given me other assistance. Dr. W. K. Gregory has given the manuscript a critical reading, and has made helpful suggestions.

The genera included in this family are: *Perognathus,* the pocket mouse; *Heteromys* and the very closely related form *Liomys,* the spiny pocket mice; *Dipodomys,* the kangaroo mouse; and *Microdipodops,* the pigmy kangaroo mouse, all living forms, found occasionally as fossils; *Diprionomys* from the Thousand Creek Pliocene of Nevada; *Peridiomys* from the Snake Creek Pliocene of Nebraska; **Mookomys,** new genus, from the Deep River Miocene of Montana, and from ?Colorado; and *Heliscomys* from the White River Oligocene of Colorado. These genera are discussed below in their stratigraphic sequence.

ORDER **RODENTIA**

Suborder **SCIUROMORPHA**

Family **Heteromyidæ**

$I\frac{1}{1}$, $C\frac{0}{0}$, $P\frac{1}{1}$, $M\frac{3}{3}$. Infraorbital foramen at the end of a long canal. Frontal without postorbital processes. Skull not of a fossorial character. Zygoma slender. Upper incisor sometimes grooved (in *Perognathus*, *Dipodomys*, *Mookomys* and *Microdipodops*, but not in *Heteromys* or *Liomys*). Teeth brachydont and bunodont in the Oligocene, becoming progressively more hypsodont and, especially, more lophodont. Range, western United States and Central America, and a small portion of southern British Columbia. Known time range, Oligocene to Recent.

HELISCOMYS Cope, 1873

White River Oligocene of Colorado. A small form, about the size of the recent pocket mouse, *Perognathus*, with a primitive dentition, fairly close to that of the Eocene stem rodent, *Paramys*. The tooth pattern of *Heliscomys* is easily derivable from a tritubercular type. There is no trace of lophs or crescents, but merely cusps. P_4 is tricuspidate, M_{1-3} quadritubercular, with a broad cingulum along the buccal margin. The upper dentition and the skull are unknown.

Heliscomys vetus Cope

COPE, 1873, and COPE, 1884, Pl. LXV, figs. 14, 16, 16a and 17.

TYPE.—Amer. Mus. No. 5461, a lower jaw, containing M_{1-2} left, from the White River Oligocene of Colorado.

PARATYPE.—Another lower jaw, Amer. Mus. No. 5462, containing P_4–M_1 left, from the same horizon.

This is the only known species of the genus. The teeth are bunodont and brachydont. P_4 is triangular, with the apex at the postero-external corner, and has but three cusps. If *Heliscomys* was descended from *Paramys* or a closely related form, as seems probable, the ancestral form had a protoconid, metaconid, hypoconid and entoconid on P_4. As there are, however, but three cusps on P_4 of *Heliscomys*, one of these must have been lost, and inspection of the specimen indicates that this was the metaconid. This explanation of the three cusps as the protoconid, hypoconid and entoconid, seems much more likely than that the tooth is primitive, and that the three cusps are protoconid, paraconid, and metaconid, as, in that case, there could be no known ancestors to *Heliscomys*, and it would be widely separated from the Oligocene rodents, which seems very improbable.

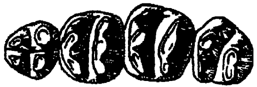
M_1 is essentially what would be expected in the lower teeth of an unspecialized Oligocene rodent, i.e., the pattern is dominated by four subequal cusps arranged in a square. These are the protoconid, metaconid, hypoconid and entoconid. There is a small cusp, which may be called the entoconulid, on the anterior side of the entoconid, in the median valley. This valley is slightly deeper than are the antero-posterior valleys, and opens unimpeded, at its lingual end. There is a broad external cingulum running the entire length of the tooth. There are slight elevations of this, which may be termed protostylid and hypostylid, anticipating the condition found in the Miocene **Mookomys altifluminis**, to be described below. Both of these stylids, but particularly the hypostylid, are so small as to be almost indistinguishable. There is an anterior cingulum, which may connect with the protoconid, in which case it would perhaps be the remains of the paraconid. M_2 is indistinguishable from M_1. The molars of the holotype are rhombic; that of the paratype is quadrate. The teeth are two-rooted. The incisors are long and slender.

These molars, then, could be readily derived from some form such as an early Eocene paramyid, in which the lower molars were quadritubercular, but which did not have the cingulum. The premolar is different from that of any known paramyid, as these are all quadritubercular, whereas *Heliscomys* is tritubercular, which is doubtless a more specialized condition, due to reduction.

Heliscomys, however, could not have been descended from *Gymnoptychus* (*Adjidaumo*) as has been suggested, since, in this last form, the hypoconids are developing into crescents, the posterior horn of which connects with the entoconid, while the anterior runs forward on the posterior side of the median valley. The premolar is quadritubercular. There is no trace of an external cingulum on the molars. The teeth are quite lophodont, indicating a stage of evolution further advanced than that reached by *Heliscomys*, even though *Gymnoptychus* comes from the Lower Oligocene Titanotherium beds and *Heliscomys* from the Middle Oligocene. The characters of *Gymnoptychus* warrant its inclusion in the Geomyidæ rather than in the Heteromyidæ. Nevertheless, it is doubtless related to *Heliscomys*, the two probably being descended from a common ancestor, perhaps in the Upper Eocene. Although in many respects *Heliscomys* is more primitive than *Gymnoptychus*, yet there are enough differences to indicate that *Heliscomys* could not have been ancestral to *Gymnoptychus*.

MOOKOMYS, new genus

The genotype is **Mookomys altifluminis**, new species, described below. P_4 is quadritubercular. M_{1-3} are bilophodont, each loph formed of three cusps in a transverse row, the outer cusp of each loph being derived from the external cingulum, which is so well developed in *Heliscomys*. The antero-posterior valleys between the cusps of each loph, draining into the median valley, are much shallower than are those of *Heliscomys*, and become progressively shallower in the later species, approaching the conditions found in *Perognathus*. The teeth become progressively hypsodont. The upper incisor is grooved on its anterior face. The external cingular cusps are more elevated in the later species. *Mookomys* differs from *Perognathus* in the more primitive characters of P_4, which is quadritubercular in the fossil genus and bilophodont in the living one. In *Perognathus*, the premolar is fully molariform. Also, the cusps of the molars of *Mookomys* are distinct for much of the animal's life, which is not the case with *Perognathus*. Finally, the tibia and fibula of *Mookomys* are not ankylosed as are those of *Perognathus*.



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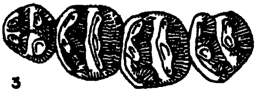

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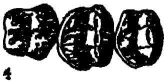

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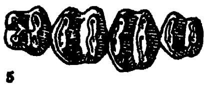


Fig. 1. *Mookomys parvus*. P_4–M_3 right. Y. M. No. 10362

Fig. 2. *Heliscomys vetus*. P_4–M_2 left. Composite of A. M. No. 5461 and No. 5462.

Fig. 3. *Mookomys parvus*. P_4–M_3 right, reversed, so as to correspond with the other figures. Y. M. No. 10362.

Fig. 4. *Mookomys altifluminis*. P_4–M_2 left. A. M. No. 21360.

Fig. 5. *Perognathus fallax*. P_4–M_3 left. A. M. No. 5066.

The lingual surfaces in Figs 2-5 are toward the top of the page. All figures seven times natural size.

Diplolophus parvus Troxell, which was referred to *Heliscomys* by Hay (1930), is much nearer to the type species of *Mookomys* than to that of *Heliscomys*, as the molars are definitely lophodont and the premolar is quadritubercular instead of tritubercular, and the species has for this reason been referred to *Mookomys*.

Mookomys altifluminis is made the genotype, rather than *M. parvus*, as the horizon of the former is definitely known, whereas that of the latter is highly speculative. Moreover, the specimen of *M. altifluminis* is more complete, there being associated part of the skull and portions of the skeleton, as well as parts of both rami of the lower jaw, instead of being only a ramus of the lower jaw, as in the case of *M. parvus*.

The genus is named for Dr. C. C. Mook, who has very kindly allowed me to describe the rodents which he collected in Montana in 1925.

Mookomys parvus (Troxell)

TROXELL, 1923, Figs. 3–5.

SYNONYMY:

Diplolophus parvus TROXELL, 1923.

Heliscomys parvus HAY, 1930.

TYPE.—Yale Mus. No. 10362, one ramus of the lower jaw, containing the incisor and P_4–M_3 right, perhaps from Colorado.

There is little real relationship between this species and *Diplolophus insolens* Troxell, the genotype, whose teeth are much more hypsodont, as well as more fully lophodont, and which has lost P_4. In addition, the cusp pattern of the teeth is quite different in the two forms. The relationship of *Mookomys parvus* to *Heliscomys vetus*, as indicated by Hay, seems to be quite genuine. This species, however, is more specialized than *H. vetus*, as two cusps, the protostylid and hypostylid, have been developed on the elevated external cingulum, from which they are differentiated, though slightly, leaving no doubt as to their mode of origin. Moreover, the individual cusps are much less independent of each other than in *H. vetus*, and they are beginning to unite into lophs, due to the obliteration of the antero-posterior valleys. The teeth are more hypsodont than in *H. vetus*. These differences are those listed above as generic characters of *Mookomys*, and warrant its inclusion in that genus, rather than in *Heliscomys*.

P_4 is essentially quadritubercular, composed of four cusps. If this form is descended from *Heliscomys*, as seems likely, the two posterior cusps would be the entoconid and the hypoconid. Doctor Gregory suggested that the two anterior cusps are the protoconid and a pseudometaconid, developed, by splitting, from the protoconid. The shape of P_4 in *M. parvus* and *M. altifluminis* is an indication of the correctness of this opinion, as the two anterior cusps are much closer together in *M. parvus* than they are in *M. altifluminis*, and the general appearance of the former fits with its being derived from the tricuspidate *Heliscomys*. This is a considerable advance over the conditions in *Heliscomys*, but it is not as great a one as it would be if any other interpretation of cusps were used. The median valley is but little deeper than the antero-posterior ones. There is a small posterior cingulum. In M_1, the two stylids are present, though the protostylid is much lower than are the primitive cusps, having been only slightly worn before the death of the animal, which was fully adult. This cusp can easily be seen to be merely an expansion and further elevation of the external cingulum. The hypostylid shows a strong incipient tendency to fuse with the hypoconid. The external cingulum continues, anteriorly to the protostylid, and curves around to the anterior border of the protoconid. There is a well developed posterior cingulum. The structure of M_2 is almost identical with that of M_1. The protoconid is separated slightly from the elevated anterior portion of the cingulum by a shallow valley, and but little more wear would be required to cause the two to unite. The hypostylid is here very closely joined to the hypoconid. In M_3, the protoconid is similar to that in M_2. The protostylid, however, is not very well developed, being an elevated point on the cingulum, which is but little enlarged in diameter. The hypostylid is a very small cuspule on the postero-buccal surface of the hypoconid. It is much lower than are the other cusps, and would not be worn until the tooth was reduced almost to the roots. *Mookomys parvus*, then, is similar to *Heliscomys vetus*, but is definitely more specialized.

The horizon from which *Mookomys parvus* came is, unfortunately, not known. The original label and the Yale catalog give no information as to the date, locality, horizon, collector, or anything else. For this reason, any reference of this fossil to a given formation or locality must involve considerable doubt. *Diplolophus insolens*, Yale Mus. No. 10368, is from the White River of Colorado. As the catalog numbers of the two specimens are so nearly the same (10362 and 10368), it is probable that they were parts of the same season's collection. On the basis of this, Troxell describes *Mookomys* (*Diplolophus*) *parvus* as from the "Oreodon Beds of the Middle Oligocene, probably from Colorado." Since the catalog numbers were not given in the field, but after the specimens were in the Museum, the fact that the numbers were so close to each other does not prove that they were collected in the same locality, but, at most, only that they were sent in to the Museum together. As there are Miocene as well as Oligocene beds scattered throughout northeastern Colorado, *M. parvus* might as well have been from the former as from the latter beds. Since, however, *M. parvus* is structurally so far advanced over *H. vetus* from the White River, and close to, but more primitive than, *M. altifluminis* of the Deep River, it is perhaps legitimate to guess that it may have been from the Pawnee Creek or Martin Canyon Lower Miocene beds, rather than from the Cedar Creek Oligocene beds. It would seem unlikely that two forms, so close together as are the two species of *Mookomys*, should be separated by the length of time from the Middle Oligocene to the Middle Miocene, and that two forms as distinct as *M. parvus* and *H. vetus* should be found in the same beds. If, however, *M. parvus* were from the Lower Miocene, there would be time intervals of about the right size, both below and above it, to account for its differences from *H. vetus* and *M. altifluminis*. Nevertheless, even if *M. parvus* were from the White River, it would still be morphologically an intermediate stage between an early heteromyid, almost identical with *Heliscomys vetus*, and the later members of the family.

Mookomys altifluminis, new species

TYPE.—Amer. Mus. No. 21360. Both rami of the lower jaw, with the posterior portions broken off, containing I_2, P_4, M_{1-2} left, I_2 right and the alveoli of P_4 and M_1 right, a fragment of the skull with I^2 left, and various portions of the skeleton, of a young individual.

Collected by Dr. C. C. Mook, August 16, 1925.

HORIZON AND LOCALITY.—Deep River beds, seven miles south of Logan, Montana.

DIAGNOSIS.—The specific characters, as far as determinable, are M_{1-2} made up of two lophs, which, in a young individual, are each visibly formed by the union of three cusps in a buccolingual row. Moderate wear would cause the disappearance of all trace of these cusps as individual entities. The stylids are of almost the same height as are the primary cusps. There is practically no trace of an external cingulum across the median valleys. The teeth differ from those of *M. parvus* in being much more lophodont, more hypsodont, and in having shallower antero-posterior valleys. The tibia and fibula are separate throughout, instead of being united distally as in *Perognathus*.

This species is evidently congeneric with *Mookomys parvus*. In spite of the incompleteness of the material, there are sufficient structural advances in this form over *Heliscomys vetus*, in both premolar and molars, to warrant its being made a new genus. Moreover, the fact that one is Deep River and the other White River gives corroborative support to their separation, as apparently no genera of mammals are known to extend, unchanged, through this period of time.

The teeth show a marked advance over *M. parvus* toward *Perognathus*. The cusps are much less distinct in *M. altifluminis*, a young individual with P_4 just beginning to be worn, than in *M. parvus*, an adult, whose teeth had been in use for some time. This form, then, is a structural intermediate between *Heliscomys* and *Perognathus*, with *M. parvus* intercalated between *Heliscomys* and *M. altifluminis*.

The fragment of the skull contains part of the premaxillary and maxillary of the left side, and extends as far posteriorly as the end of the diastema. The upper incisor is very similar to that of *Perognathus fallax*, having about the same radius of curvature, being of about the same width, and likewise having a groove on the anterior surface. The extreme tip of the upper incisor is broken off. The diastema is of similar length in the two animals. The lower incisor is complete to its tip. Its radius of curvature is similar to that of *Perognathus*, but the portion of the tooth above the alveolus is much shorter in the fossil form.

P_4 shows a slight advance over that of *M. parvus* in specialization toward the *Perognathus* type. This tooth is formed by four subequal cusps, which have just begun to show wear on their tips. The pseudo-metaconid and protoconid are closer together than are the entoconid and hypoconid, and are slightly smaller. They are, however, farther apart than are the corresponding cusps of *M. parvus*. The median valley opens widely at its lingual end. Buccally, it is partially dammed by a small external cingulum. The anterior and posterior tributary valleys are slightly closed at their ends farthest from the median valley. There are two subcircular roots, one anterior and one posterior.

M_1 is divided into a well marked metalophid and hypolophid, with a deep median valley between them. The metalophid is somewhat higher than the hypolophid. Under each loph is a transversely elongate root, extending the entire width of the tooth. The metaconid forms the narrowest part of the triangular metalophid. It is marked off from the protoconid, at the stage of wear in the present individual, by a slight groove. Lateral to this is a well developed protostylid, which is, however, a shade lower than the other cusps of the metalophid, so that, in the stage of wear that the tooth has reached, this cusp shows only very slight traces of wear. The enamel forms a continuous crest along the anterior margin of the metalophid. The three cusps of the hypolophid are more nearly equal in size than are those of the metalophid. The hypoconid is the largest, the entoconid the next, and the lateral cusp, the hypostylid, the smallest. The hypolophid is bounded posteriorly by a continuous enamel crest, which is not, however, as straight as is the crest of the metalophid, being indented between the cusps. The median valley is deep and opens widely, both buccally and lingually, with only a very slight trace of an external cingulum. The side valleys are good examples of "hanging valleys," entering well up on the sides of the median valley.

M_2 is quite similar to M_1, but there is more difference in height between the metalophid and hypolophid than in M_1. The antero-posterior diameter of the tooth is considerably less. The metalophid is more nearly of a uniform width, instead of being expanded in the region of the protoconid, as it is in M_1. There is no external cingulum at the buccal end of the median valley.

The extension of the nasals anterior to the edge of the alveolus of the incisor is quite similar in its proportions and size to that in *Perognathus*. Associated fragments of the skeleton are an astragalus and calcaneum, part of the pelvis, the head and shaft of both humeri, the distal end of the femur, portions of the tibia and fibula, several metapodials, a dorsal vertebra, two caudal vertebræ, and some fragments.

The tibia and fibula were separate for their entire length, instead of being coössified in the distal half, as are those of *Perognathus*. Other than this, the skeleton, so far as it is known, is essentially similar to that of *Perognathus*. These parts of the skeleton would indicate that *Mookomys* was a quadrupedal, swift-running animal, similar to *Perognathus*, which had not yet begun to specialize on the line leading to the kangaroo rats, and which probably could not run on its hind legs for even the few steps that *Perognathus* sometimes does.

It is possible that *M. altifluminis* is directly descended from *M. parvus*, as the tooth patterns of the two forms are so closely alike, the differences consisting largely of a few changes along the lines already laid down by the evolution of *M. parvus* from *H. vetus*. The chief reason for doubting whether this could be a direct phylogenetic sequence is that *M. parvus* is slightly larger than *M. altifluminis*. There is a general assumption that in any phylogenetic line, the ancestral forms are always either the same size as the descendants, or else of smaller size. In general, this is likely to be correct. But I do not believe that there is any innate force causing such an effect, but merely that the forms that have been studied the most, and which are the most fully known, are those that are the largest. As the modern mammals have all been derived from small ancestors in the Eocene, these well-known forms all show a derivation from smaller ancestors. Certainly there is no genetic reason why the descendant might not be smaller than the ancestor. Moreover, the difference is so small as to be almost negligible, and might be merely an individual variation. There is a small hypostylid on M_3 of *M. parvus*, which is not present in *Perognathus fallax*. This may indicate that *M. parvus* is slightly off the direct line to *Perognathus*. In any case, however, it does not make much difference whether *M. parvus* is really the ancestor of *M. altifluminis* or is merely so closely related to its ancestor as to be practically indistinguishable from it. In *M. parvus*, M_2 is slightly larger than M_1. In both *M. altifluminis* and *Perognathus*, the reverse is the case.

PERIDIOMYS Matthew

Peridiomys rusticus Matthew

MATTHEW, 1924, Fig. 9.

The type, Amer. Mus. No. 18894, from the Lower Snake Creek Pliocene of Sioux County, western Nebraska, is the lower jaw containing P_4-M_2 left, of a member of this family, related to *Mookomys* and *Perognathus*, but not intermediate between the two. The teeth are more hypsodont than in *Perognathus*, and the median valley is shallower, particularly on the lateral side of the tooth. In this respect, *Peridiomys* is more like *Heteromys*, to which it may be ancestral. The teeth are considerably worn, so that the cusp pattern cannot be accurately determined. In P_4, however, four main cusps can be seen. The pseudo-metaconid and entoconid are considerably larger than are the protoconid and hypoconid. There is a small cusp which may be called a pseudo-metaconulid, on the inner side of the pseudo-metaconid. The cusps have united into two transverse lophs, though the median valley has been almost worn away. Before being worn, the antero-posterior valleys were probably quite deep, though perhaps more shallow than those of *Mookomys*. In M_1 and M_2, nothing can be told of the pattern other than that there are two transverse lophs. These are so very similar in size and shape to those of *Mookomys* and *Perognathus* as to indicate that they were probably formed in the same way, by the union of three cusps in a buccolingual row. The lateral portion of the metalophid was large. This form cannot have been ancestral to *Perognathus*, as it is too large, the structure of P_4 is different, and the teeth are more hypsodont.

Hall suggests that *Peridiomys* may be synonymous with *Diprionomys* Kellogg, the differences being due to greater wear in the specimens of the latter genus. I have not been able to study the specimens of *Diprionomys*, but I have compared Hall's figures and descriptions with *Peridiomys*. The differences in pattern between the molars of the two forms could easily be due to wear. The premolars, however, have slightly different patterns—that of *Peridiomys* having the metaconulid mentioned above, and being bilophodont for a larger portion of the animal's life than that of *Diprionomys*. The premolar of *Peridiomys* is shorter antero-posteriorly in proportion to its width than are the premolars of the various species of *Diprionomys*. A more important distinction is that of the shape of the teeth—those of *Diprionomys* being essentially circular, and those of *Peridiomys* being much wider than they are long (for details of the comparison, see the table of measurements). For these reasons, although further material may prove the two genera to be identical, for the time being I believe it best to keep them separate. *Peridiomys*, it seems to me, may well be ancestral to the closely related *Heteromys* and *Liomys*. The lower premolar of *Peridiomys* is simpler than that of *Heteromys*, but is essentially the same as that of *Liomys*. *Peridiomys* is slightly larger than *Liomys*. It is practically the same size as some species of *Heteromys*, as *H. nelsoni*.

DIPRIONOMYS Kellogg

KELLOGG, 1910, Figs. 17, 17*b* and 18; HALL, 1930, Figs. 2–12.

This genus, from the Thousand Creek Pliocene of Nevada, is also known chiefly from lower jaws, though fragments of skulls have recently been described by Hall for two of the four species. The teeth of most of the specimens are in an advanced stage of wear, so that no trace of the cusps remains. In P_4, there are a functional metalophid and a hypolophid. In worn teeth, these unite in the middle of the tooth. The shape of the "metalophid" varies in different species as well as with wear. M_1, in an unworn specimen, is made on the same pattern as that of *Mookomys*—having two lophs, each composed of three cusps. In a worn tooth, the lophs unite, beginning with the lingual side, and, in an old animal, the tooth is reduced to a circle of enamel surrounding a dentine area in the center. The upper teeth resemble those of *Perognathus* and *Liomys*. They differ from those of *Perognathus*, however, in being more hypsodont, resulting in a much shallower median valley, so that the protoloph and metaloph are united much earlier in the animal's life than in the case of *Perognathus*. In this respect *Diprionomys* is much like *Liomys*. *D. parvus* is the most primitive member of the genus, and may be ancestral to the others. A more specialized member of the genus, as *D. quartus*, may have been ancestral to the kangaroo rats, *Dipodomys* and *Microdipodops*, as Hall suggested, though it does not have the grooved incisor characteristic of the modern genera. P_4 of these animals is more specialized than in *Diprionomys*, but the characters of the two forms are such as to allow *Diprionomys* to be their ancestor. I do not believe, however, that Hall is correct in deriving *Perognathus* and *Liomys* from *Diprionomys*. The proportions of P_4 in *Perognathus fallax* and *Diprionomys tertius* are quite different, the former being essentially of equal dimensions, and the latter elongate antero-posteriorly. The diastema of *Diprionomys* is much longer than that of *Perognathus* and the dentary is much deeper. It seems to me that *Peridiomys* is more closely related to *Liomys* than is *D. quartus*. If *Diprionomys* is ancestral to the kangaroo rats, which are the only members of the family known to be jumping forms, it is probable that *Diprionomys* was tending in this direction. But just what stage had been reached cannot be told until fossils are found showing the hind feet. It is, perhaps, justifiable to assume that they were more or less in the stage reached by *Perognathus*, which very occasionally rises onto its hind legs.

PEROGNATHUS Maximilian

Perognathus fallax Merriam

MERRIAM, 1889, Fig. 12.

This species was selected to represent the genus, chiefly because a young specimen was available, showing the pattern of the unworn dentition. In this genus, the molars are hypsodont and lophodont, and the separate cusps are reduced to small rugosities on the upper surface of the unworn teeth. A very little wear causes all trace of these cusps to disappear, leaving nothing but the two transverse lophs. There are no traces of cingula. P_4 is quadritubercular, with a connection between the middle of the two lophs. M_1 and $_2$ are sextitubercular. M_3 is quinquetubercular, with no trace of a hypostylid. This would seem to indicate either a slight retrogressive evolution from the *Mookomys parvus* stage, where there is a minute hypostylid, or else that *Perognathus* is descended from a form related to *M. parvus*, but which did not have the hypostylid. What this tooth indicates about the unknown M_3 of *Mookomys altifluminis* is difficult to say. It seems reasonable to assume, however, that either the hypostylid was absent, or, if present, extremely small. There is no trace of an external cingulum closing the median valley on any of the lower teeth, although in an old skull the two lophs begin to connect on the median side.

P^4 has a small, apparently unicuspular protoloph, followed by a tricuspid metaloph. The cusps of this seem to be the metacone, hypocone, and either a hypostyle or hypoconule. Whether the protoloph is formed by the protocone, the paracone, or by a fusion of the two, is impossible to determine from this form alone. *Dipodomys* (see below) seems to indicate that the anterior crest is formed by the protocone and paracone. M^1 and ^{2} are essentially similar to the lower molars, being formed of two transverse lophs, made up of paracone, protocone, and protostyle, and metacone, hypocone and hypostyle, respectively. In M^2, there is an internal cingulum which tends to close the median valley. M^3 is formed of the four primitive cusps, together with a protostyle, continued posteriorly as a very strong internal cingulum of essentially the same height as the two lophs. There is, however, no distinct hypostyle.

The incisors are stouter than in *Mookomys*, and the upper incisors are grooved. The tooth pattern of this genus is very easily to be derived from that of *Mookomys*. The tibia and fibula are ankylosed at their distal ends. All that is required to form *Perognathus* from *Mookomys* is a further specialization of the teeth along the lines followed in the evolution leading up to *M. altifluminis*, and a specialization of the limb bones, as indicated by the union of the tibia and fibula.

Perognathus furlongi Gazin

Gazin, 1930, Pl. iii, Figs. 5, 5*a* and 6.

The type, Cal. Inst. Tech. No. 35, is the anterior portion of a skull containing the cheek teeth of both sides, from the Cuyama Miocene beds of California, which have been correlated with the Upper Miocene Barstow beds. This makes this specimen but slightly younger than *Mookomys altifluminis.* The portions preserved are distinctly perognathoid in character. While this may be the upper dentition of *Mookomys,* it is so close to *Perognathus* that I believe Gazin was correct in referring it to that genus. From Gazin's figures, it would seem that the anterior loph of P^4 is composed of but a single cusp, and the posterior of three, just as in the living species of the genus. M^1 is sufficiently little worn to show three cusps on the protoloph. The median valley is closed internally by an elevated cingulum. This shows that this species is more advanced than *M. altifluminis,* since, in that form, the cingulum does not close the valley until the teeth have been considerably worn. It is also more advanced than *P. fallax.* M^2 is similar to M^1, but smaller. The figure does not show any cusps. M^3 is broken off.

This species, it seems to me, though the earliest known member of *Perognathus,* is probably not ancestral to all the later members of the genus. It is not very far removed from *Mookomys altifluminis.* There are, however, more differences between *M. altifluminis* and *P. furlongi* than between the latter and *P. fallax,* so I have drawn the dividing line here.

HETEROMYS Desmarest

Goldman, 1911, Pl. i, Figs. 1–2.

The teeth of an adult of this genus, in which the original crown pattern has been lost, are not very different from those of the other members of the family. The lower molars seem to have had the same basic pattern as those of *Mookomys,* and do not seem to have been greatly modified beyond that. However, in some species, there is a cusp developed from a posterior cingulum on M_3, in the center of the posterior side of the tooth. This is, however, inconstant, being sometimes present on one side of the animal and not on the other. There has also been a union of the metalophid and hypolophid, on the buccal border of the tooth, so that the crown pattern is a U. This connection is a portion of the external cingulum which has not been elevated as high as the protostylid and hypostylid portions were. This would indicate, perhaps, that *Heteromys* cannot be derived from *Mookomys altifluminis*, as there is practically no trace of the cingulum closing the valley in that form. *M. parvus*, however, would be a satisfactory ancestor, as it possesses the complete cingulum. *Peridiomys*, however, could be an intermediate stage between *M. altifluminis* and *Heteromys*.

P_4 is much more advanced in its pattern than is that of *Mookomys*. The cusps have fused into two transverse lophs, connected at their external margins, as in the molars. This lends strength to the supposition that an external cingulum has developed, with the formation of the two stylids, as in the molars. Furthermore, an anterior loph has appeared in front of the "metalophid." This may have developed from an anterior cingulum, as it is connected with the "metalophid" at the external margin of the tooth, where the "metalophid" has been derived from the elevated external cingulum. It is also connected with the middle part of the "metalophid." This crest is in about the right place to be homologized with the paraconid, though it is probably not that cusp, which seems to have disappeared in the Heteromyidæ by the Miocene.

The pattern of the upper molars is identical with that of the lowers, except that, as so very frequently occurs among mammals in general and rodents in particular, the pattern is reversed. The only visible difference in a worn tooth is that the lophs are connected at their median instead of at their lateral ends. In P^4, however, the pattern is quite different from that of P_4. The posterior loph curves around on the median side, in a hook-shaped process, toward the single anterior cusp. It is impossible to say, on the basis of this genus alone, whether the hook on the metaloph properly belongs to the protoloph, or whether it is a metastyle moving toward the protoloph. Comparison with *Dipodomys*, however, tends to support the latter explanation.

The upper incisor is not grooved. The tibia and fibula are fused for their distal halves. This form is quadrupedal at all times.

As *Heteromys* and *Liomys* do not have a grooved upper incisor, it is possible that the upper incisor of *Peridiomys* was not grooved. If this were so, it would indicate that *Peridiomys* was probably derived from a form related to *Mookomys altifluminis*, but without the groove, although this groove may have been secondarily lost in the recent genera.

LIOMYS Merriam

GOLDMAN, 1911, Pl. I, Fig. 3.

This genus is a very close relative of *Heteromys*, but is a more primitive type. The lower molars have the same pattern as do those of *Heteromys*. In the premolar, however, the pattern is much simpler than that of *Heteromys*. The hypolophid is essentially similar in the premolars of the two genera. The protoconid and pseudo-metaconid of *Liomys*, however, are quite distinct from each other, and remain separate for some time. Moreover, there is no trace of the additional anterior loph. There seems to be a tendency for the antero-posterior connection of the lophs of the molars to show itself later in life than in *Heteromys*. The upper teeth, also, have essentially the same pattern as in this last genus, again the only important difference being in the premolar. Here the median hook of the metaloph is less well developed and looks much more like a metastyle than it does in *Heteromys*. It seems obvious that *Liomys* and *Heteromys* have had a common ancestor at a not very distant period. Probably this ancestor was more nearly related to *Liomys* than to *Heteromys*, and may have been close to *Peridiomys*.

DIPODOMYS Gray

GRINNELL, 1922, Fig. C.

The genus is the kangaroo rat of western North America. P_4 has an anterior loph as in *Heteromys*. This form is, however, in a different line, since the anterior loph is connected at both ends with the "metalophid." There are two median cusps and one lateral cusp on the "metalophid." This anterior crest seems to be pushed out from the "metalophid," though this appearance may be a secondary development. The hypolophid is formed of three cusps. The separation of the cusps from each other is about as distinct as in *Perognathus*. There is no trace of an external cingulum. In the molars, there are six cusps, arranged in two rows, with practically no separation between the cusps of each row. There is, however, a strong external cingulum closing the median valley. The upper premolar shows the protoloph to be formed by two cusps. It thus seems to be in a stage structurally ancestral to those of *Heteromys* and *Perognathus*, where no such division is discernible. In the metaloph are three cusps, the hypostyle being continued anteriorly as a cingulum which partially closes the median valley. The upper molars, like the lower, are composed of three cusps in each loph. The median valley is closed by an internal cingulum, which connects the protostyle and hypostyle. The upper incisor has a groove on its anterior face. The lower half of the tibia and fibula are ankylosed. This animal is saltatorial, being entirely bipedal.

MICRODIPODOPS Merriam

This genus is closely related to *Dipodomys*, and has a similar habitat. The chief difference between them is one of size. In the teeth, $M\frac{3}{3}$ of *Microdipodops* are very small in proportion to the other teeth, being minute nodules. The teeth, when worn, become enamel ovals, surrounding an area of dentine in the center. The upper incisor is grooved. The tibia and fibula are united throughout, so that this process reaches its culmination in this genus.

These two genera of kangaroo rats are probably derived from a common ancestor in the Pleistocene or late Pliocene. They were very possibly ultimately derived from *Diprionomys quartus*, by a specialization of P_4.

Would it not now be possible, on the basis of our knowledge of the tooth pattern of the upper teeth of the recent forms, to reconstruct that of the fossil genera? Since in most of the more specialized rodents, including the Heteromyidæ, the patterns of the upper and lower teeth are essentially mirror images of each other, it follows that, when we know the lower teeth, we can determine, with reasonable accuracy, the pattern of the uppers. And, also, when two forms have similar lower teeth, their upper teeth ought also to be similar. In *Mookomys*, the pattern of the lower molars is essentially that of the lower molars of *Perognathus*. This should mean, in accordance with the principle cited above, that the pattern of the upper molars was also essentially the same. Of course, this should be considered only a hypothesis until the upper teeth are found. This resemblance in pattern of the upper and lower teeth is of considerable value to the palæontologist, as it makes the lower jaws of rodents as serviceable for identification as an upper dentition. This is especially important, as, for some reason, the lowers are much more common as fossils than are the uppers.

The resemblance between the upper and lower premolars of *Mookomys* was probably not quite as great as that between the molars. The upper premolar was, however, probably more primitive than a *Perognathus* premolar, and more quadritubercular, thus resembling the lower premolar.

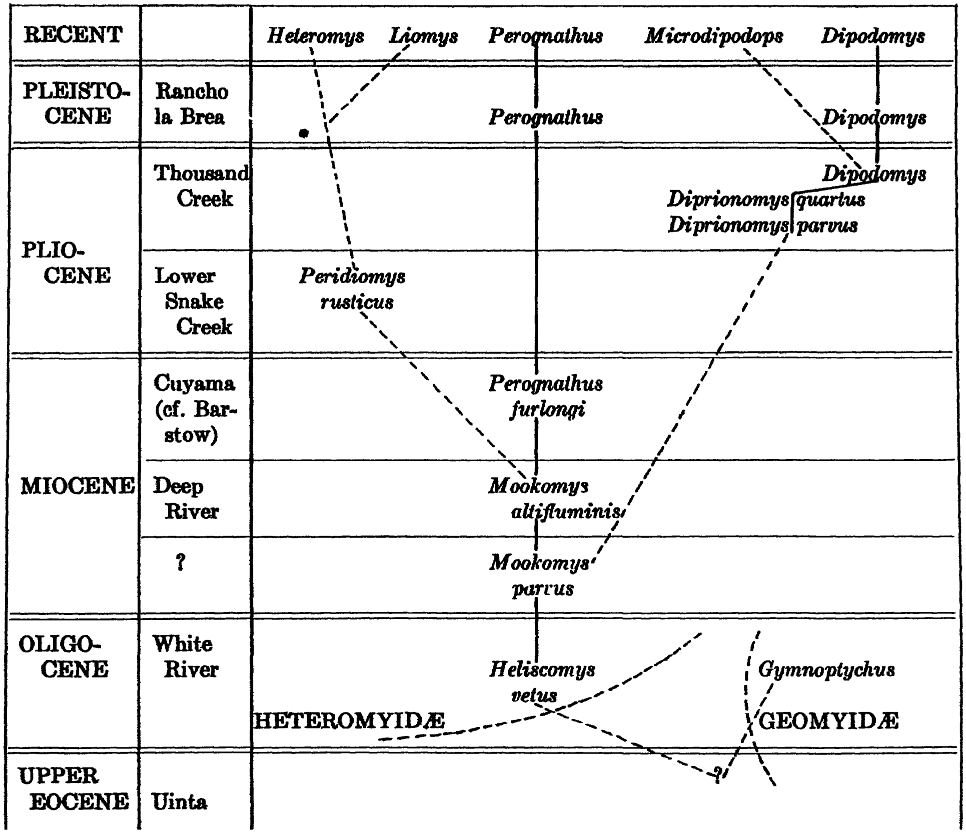
We should have, then, in Miocene heteromyids, a series of parallel ridges, which, in mastication, would oppose each other, and wear on the surface of the corresponding ridge on the other jaw. This would be a necessity, as the motion of the jaws of a rodent has a backward and forward component when chewing, and no motion of this sort would be possible if the crests interlocked. An occlusion of this sort, with the lower jaw moving antero-posteriorly, would give only a limited grinding surface, and would seem to supply a sufficient reason for the positive selection of forms in which the teeth were elevated into lophs, and the median valleys were reduced in depth and width. A tooth of this sort, after a very moderate amount of wear, has a much larger grinding surface than does one of the type of *Mookomys*. It is interesting to note, as supporting this theory as to the origin of the tooth pattern of the more specialized forms, that all the recent genera of the family have undergone modifications of this sort, and that there are no living rodents in which the teeth are of the *Mookomys* type. In the lagomorphs, whose jaws move transversely during mastication, the teeth have antero-posterior differences in height. These facts suggest that there is a positive selection of forms with the perognathoid type of dentition, as opposed to those with teeth of the *Mookomys* variety.

This picture of the upper teeth of *Mookomys* was based partly on the upper teeth of *Perognathus* and partly on a mirror image of the lower teeth of *Mookomys*. It could, however, have been derived equally well by determining, from a study of the recent genera, what their common ancestor should have been like. This lends support to the essential accuracy of the description.

The accompanying phylogenetic chart indicates the probable inter-relationships of the different members of the family. *Mookomys* is probably descended from *Heliscomys*, and *Perognathus* and *Peridiomys* from *M. altifluminis*. *Heteromys* and *Liomys* are perhaps derived from *Peridiomys*. *Dipodomys* and *Microdipodops* may have been descended from a stage similar to *Mookomys parvus*, through *Diprionomys*.

One of the aspects of this phylogenetic series which will be of interest to the palæontologist is the manner in which it shows, clearly and definitely, that, in this family of rodents, at least, the teeth have been derived from a tritubercular pattern which existed in the Eocene or Oligocene. While it has long been suspected that such was the case for all the rodents, as well as for other mammals, proof has been wanting for most of the members of the order. This series also shows, in some of the later forms (as *Heteromys*), the early stages in the multiplication of crests which is so common among the rodents, and which is carried to such extremes among the Hystricomorpha.

Phylogenetic Chart of the Heteromyidæ



MEASUREMENTS OF RECENT AND FOSSIL HETEROMYID RODENTS

All Measurements in Millimeters

	Heliscomys vetus. A. M. N. H. 5461. M_{1-2} left, Measured by Wood.	*Heliscomys vetus.* A.M.N.H. No. 5462. P_4–M_1 left. Measured by Wood.	*Mookomys parvus.* Y.M. No. 10862. P_4–M_3 right. Measured by Wood.	*M. altifluminis.* A.M.N.H. No. 21360. P_4–M_2 left. Measured by Wood.	*Peridiomys rusticus.* A.M.N.H. No. 18894. P_4–M_2 left. Measured by Wood.	*Perognathus fallax.* A.M.N.H. No. 5066. $P\frac{4}{4}$–$M\frac{3}{3}$ left. Measured by Wood.	*P. furlongi.* Cal. Inst. Tech. No. 35. P^4–M^3 left. After Gazin.	*Diprionomys parvus.* U. Cal. No. 12566. P_4–M_1 right. From Kellogg's figures.	*D. magnus.* U. Cal. No. 12567. P_4–M_2 left. From Kellogg's figures.	*D. tertius.* U. Cal. No. 29632. $P\frac{4}{4}$–$M\frac{2}{2}$ right. After Hall.	*D. quartus.* U. Cal. No. 29639. P^4–M^3 right. No. 29631. P_4–M_3 right. After Hall.	*Dipodomys merriami.* A.M.N. H. No. 6878. $P\frac{4}{4}$–$M\frac{3}{3}$ left. Measured by Wood.	*Microdipodops megacephalus.* A.M.N.H. No. 54815. $P\frac{4}{4}$–$M\frac{3}{3}$ left. Measured by Wood.	*Heteromys desmarestianus.* U. S.N.M. No. 100007. $P\frac{4}{4}$–$M\frac{3}{3}$ left. From Goldman's figures.	*Liomys inornatus.* U.S.N.M. No. 93914. $P\frac{4}{4}$–$M\frac{3}{3}$ left. From Goldman's figures.
Length of Lower Cheek Teeth	....	....	4.85	....	....	3.55	....	....	....	....	5.1	....	2.65	4.86	4.95
Length of Lower Diastema	2.85	2.23	....	3.5	....	2.65	....	4.11	....	4.22	5.00	2.65	2.72	4.20	4.36
Depth of Dentary at P_4	....	2.23	4.1	2.8	4.89	2.4	....	2.62	4.05	3.37	4.2	3.50	2.30	2.20	2.24
Depth of Dentary at M_3	....	....	....	....	3.23	1.30	....	....	....	3.02	....	....	1.83	....	....
Length of Metalophid, P_4	....	0.55	0.92	0.80	1.40	0.65	....	1.08	1.03	0.51	1.15	1.0	0.75	1.22	1.24
Length of Hypolophid, P_4	....	0.55	1.02	0.95	1.98	0.90	....	1.29	1.52	0.71	1.25	1.22	0.85	1.25	1.59
Antero-posterior length, P_4	....	0.48	0.99	1.05	1.53	0.90	....	1.32	1.53	1.2	1.5	1.45	1.00	1.35	2.00
Length of Metalophid, M_1	0.83	0.79	1.32	1.15	2.20	1.05	....	1.25	1.40	0.82	1.2	1.07	1.05	1.22	1.46
Length of Hypolophid, M_1	0.84	0.79	1.22	1.15	2.32	1.00	....	1.43	1.53	0.97	1.1	1.08	1.05	1.29	1.58
Antero-posterior length, M_1	0.84	0.84	1.28	1.10	1.57	1.05	....	1.06	1.06	1.2	1.2	1.00	0.56	1.03	1.20
Length of Metalophid, M_2	0.82	....	1.44	1.10	2.13	1.10	....	....	1.48	0.90	1.2	....	1.05	1.45	1.48
Length of Hypolophid, M^2	0.83	....	1.32	1.10	2.12	1.05	....	....	1.62	0.82	1.1	....	1.05	1.54	1.43
Antero-posterior length, M_2	0.82	....	1.30	1.00	1.82	0.95	....	....	1.02	1.0	1.3	....	0.54	0.95	1.12
Length of Metalophid, M_3	....	....	1.23	....	....	0.80	....	....	....	....	1.2	....	0.70	1.35	1.33
Length of Hypolophid, M_3	....	....	1.03	....	....	0.70	....	....	....	....	1.0	....	0.70	1.24	1.30
Antero-posterior length, M_3	....	....	1.20	....	....	0.80	....	....	....	....	1.2	....	0.45	1.29	1.12
Crown length of Upper Creek Teeth Series	....	....	....	....	....	3.32	3.4	....	....	3.77	....	....	2.70	4.59	4.54
Length of Upper Diastema	....	....	....	5.68	....	5.51	....	....	....	....	7.20	4.90	5.25	10.67	9.80
Width of P^4	....	....	....	....	....	1.28	1.2	....	....	1.25	1.40	1.34	1.02	1.44	1.81
Antero-posterior crown length, P^4	....	....	....	....	....	1.00	0.92	....	....	1.39	1.36	1.20	0.71	1.33	1.64
Width, M^1	....	....	....	....	....	1.24	1.3	....	....	1.31	1.36	1.25	1.11	1.46	1.68
Antero-posterior length, M^1	....	....	....	....	....	0.97	0.9	....	....	1.03	0.98	0.90	0.57	1.19	1.21
Width, M^2	....	....	....	....	....	1.05	1.2	....	....	0.95	1.31	1.16	0.86	1.54	1.50
Antero-posterior length, M^2	....	....	....	....	....	0.77	0.8	....	....	0.88	0.89	0.85	0.55	1.18	0.98
Width, M^3	....	....	....	....	....	0.70	0.9	....	....	0.76	....	....	0.63	1.16	1.20
Antero-posterior length, M^3	....	....	....	....	....	0.82	0.7	....	....	0.56	....	....	0.51	1.01	0.96

CONCLUSIONS

1. *Heliscomys* from the White River Oligocene is probably the common ancestor of the Heteromyidæ. A form similar to *Mookomys parvus* of the ??Lower Miocene was probably essentially ancestral to all the later forms. *M. altifluminis* of the Deep River Miocene is ancestral to *Perognathus* and *Peridiomys* and perhaps to *Heteromys* and *Liomys.*

2. *Gymnoptychus* (*Adjidaumo*) is not ancestral to the Heteromyidæ. Probably it and *Heliscomys* are descended from a common ancestor in the Upper Eocene or lowest Oligocene.

3. The dental evolution of the family was presumably caused by the comparatively inefficient pattern of the teeth in the earlier forms. Since the crests of one jaw could grind only against the crests of the other, the tendency was toward the increase in the size of the crests and the reduction in size of the valleys and interlophic spaces, which are functionless.

BIBLIOGRAPHY

COPE, E. D. 1873. Synopsis of new vertebrates from Colorado. Misc. Publ. U. S. Geol. Surv. Terr., p. 3.

1874. Report on the Vertebrate Paleontology of Colorado. Ann. Rept. U. S. Geol Surv. Terr., 1873 (1874), p. 475.

1884. Tertiary Vertebrata of North America. Rept. U. S. Geol. Surv. Terr., III, I, pp. 845–847.

GAZIN, C. L. 1930. A Tertiary vertebrate fauna from the Upper Cuyama drainage basin, California. Contr. Carn. Instn. Wash. Publ. 404, pp. 66–67.

GOLDMAN, E. A. 1911. Revision of the spiny pocket-mice. North American Fauna No. 34. U. S. Dept. Agri., Biol. Surv.

GRINNELL, J. 1922. A geographical study of the Kangaroo Rats of California. Univ. Cal. Zool. Publ., XXIV, 1, pp. 1–124.

HALL, E. R. 1930. Rodents and Lagomorphs from the later Tertiary of Fish Lake Valley, Nevada. Univ. Cal. Publ., Bull. Dept. Geol. Sci, XIX, 12, pp. 295–312.

HAY, O. P. 1930. Second Bibliography and Catalog of the Fossil Vertebrates of North America. Carn. Instn. Wash. Publ. 390.

KELLOGG, L. 1910. Rodent fauna of the late Tertiary beds at Virgin Valley and Thousand Creek, Nevada. Univ. Cal. Publ., Bull. Dept. Geol. Sci., V, 29, pp. 411–437.

MATTHEW, W. D. 1924. Third contribution to the Snake Creek Fauna. Bull. Amer. Mus. Nat. Hist., L, 2.

MATTHEW, W. D., GRANGER, W., AND SIMPSON, G. G. 1929. Additions to the fauna of the Gashato Formation of Mongolia. Amer. Mus. Nov., No. 376.

MERRIAM, C. H. 1889. Revision of the North American Pocket Mic North American Fauna No. 1. U. S. Dept. Agri., Biol .

TROXELL, E. L. 1923. *Diplolophus*, a new genus of Rodents. Amer. Jour. Sci., V, pp. 158–159.

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XVI[1]

NOTES ON FANTAILS OF THE GENUS RHIPIDURA

By Ernst Mayr

The collections sent by the Whitney Expedition from Malaita Island (British Solomon Islands) included three new forms of fantails of the genus *Rhipidura* The description of these necessitated an examination of some of the related forms. The species and subspecies that are distributed over the western part of the range of this genus (Indian, Malayan, Australian and Papuan Region) have been recently reviewed by several authors. However, little is known about the eastern species (inhabiting Melanesia and Polynesia). The splendid material of the Whitney Expedition adds a great deal to our knowledge on distribution and geographical variation of this group and gives me a welcome opportunity for this much needed revision. About 1100 specimens belonging to 34 different subspecies from more than 60 islands were studied and measured during the preparation of the present paper.

I distinguish in the region of Polynesia and the Solomon Islands the following eight species of the genus *Rhipidura:*

1.—*Rhipidura leucophrys*
2.—*Rhipidura cockerelli*
3.—*Rhipidura spilodera* (superspecies[2])
4.—*Rhipidura nebulosa*
5.—*Rhipidura flabellifera*
6.—*Rhipidura personata*
7.—*Rhipidura rufifrons* (superspecies[2])
8.—*Rhipidura malaitæ*

Three of these (1, 2, 8) are found only in the Solomon Islands and not in Polynesia, one is restricted to Polynesia (4), but is perhaps nothing more than a representative of another species (3 or 5). The distribution of these eight species is somewhat irregular, but we find in Polynesia never more than two and in the Solomon Islands never more than four on any one island.

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[1] Previous papers in this series comprise American Museum Novitates, Nos 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, 486, 488 and 489.

[2] Concerning the term superspecies, see Mayr, 1931, Amer. Mus. Novit. No. 469, p 2

Only one species is found in Samoa (4), Fiji (3 or 6), Santa Cruz (7) and on Rennell Island (3). Two species are found in New Caledonia (3 and 5), New Hebrides (3 and 5) and Banks Island (3 and 5). Three species are found on Choiseul, Ysabel, Central Solomon Islands and Florida Island (1, 2 and 7). Four species are known only from Bougainville (1, 2, 3 and 7), Malaita (1, 2, 7 and 8), Guadalcanar (1, 2, 3 and 7) and San Cristobal Island (1, 3, 5 and 7). But, even where we find four species on the same island, we will not meet them all at the same locality. Some are strictly mountain birds, others occur only near the water or have some other specialized habitat. Further details will be given in the full report on the Solomon Islands birds. For the present I want to point out only one curious fact and that is that within the species there are considerable differences in the ecological position. We have several species (for example *rufifrons* and *spilodera*) that are mountain birds on some islands, but occur also on small, low coral islands. We find the same phenomenon with *Turdus poliocephalus*[1] and in some species of *Zosterops*.[2] I lay particular stress on the importance of this phenomenon, as several systematists have claimed that preference for a certain type of habitat can always be used for the distinction between closely related species.

Rhipidura leucophrys Latham

RANGE.—Australia, Moluccas, Papuan Region, Bismarck Archipelago and Solomon Islands.

Rhipidura leucophrys melaleuca (Quoy and Gaimard)

Muscipeta melaleuca QUOY AND GAIMARD, 1830, 'Voyage de l'Astrolabe,' Zool. I, p. 180; New Ireland.

Leucocirca leucophrys amboynensis MATHEWS, 1928, Bull. Brit. Orn. Club, XLVIII, p. 92; Amboyna, S. Moluccas.

Male and female alike in coloration, but female smaller.

JUVENAL PLUMAGE.—Duller, less glossy; upper wing-coverts with brownish

	WING	TAIL	WEIGHT
24 ♂ ad.	103–110(106.4)	100–106(103.1)	37
16 ♀ ad.	99–104(101.6)	96–106(101.1)	35, 33
8 ♂ juv.	101–104(102.1)	95–101(99.0)	31
7 ♀ juv.	95–100(97.7)	90– 98(95.8) .	34

Most of the molting specimens were collected from December to April, although a few molting birds were found during every month of the year.

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[1] Mayr, 1931, Amer. Mus. Novit., No. 486, p. 22.

[2] Stresemann, 1931, Mitt. Zool. Mus. Berlin, XVII, p. 204.

Specimens Examined (Whitney South Sea Expedition).—From Solomon Islands: Poharan Island (near Buka); Bougainville Island; Shortland Island; Whitney Island; Choiseul Island; Ysabel Island; islands on the north coast of Ysabel (Gijunabena, Megapode, Bates Isls.); Vella Lavella; Bagga Island; Ganonga; Narovo; Gizo; Kulambangra; New Georgia; Tetipari; Kicha Island (east of Gatukai). Malaita; Tulagi; Guadalcanar; San Cristobal; Santa Anna and Ugi Island.

Compared with a series from New Britain and different parts of New Guinea.

There are no differences in coloration or size between the birds from these twenty-four islands of the Solomon Group. In a comparison of my measurements with those published by other authors, I find that I can do nothing better than to follow the arrangement proposed by Ogilvie-Grant (1915, Ibis, Supp. 2, p. 156), Stresemann (1923, Arch. f. Naturg. LXXXIX, fasc. 8, p. 5) and Hartert (1930, Nov. Zool., XXXVI, p. 74), who consider all the birds between the Moluccas and Solomon Islands as belonging to one subspecies. It may be noted, however, that the specimens from South New Guinea and Aru Island are, on the average, slightly smaller and approach somewhat the smaller *picata* Gould of Northwest Australia.

Rhipidura cockerelli Ramsay

Range.—The Solomon Islands, except San Cristobal Island.

Rhipidura cockerelli septentrionalis Rothschild and Hartert

Rhipidura cockerelli septentrionalis Rothschild and Hartert, 1916, Bull. Brit. Orn. Club, XXXVI, p. 73; Bougainville Island.

Subspecific Characters.—Similar to *cockerelli*, but white spots on the breast averaging larger; more white on under wing-coverts and secondaries; back less blackish.

	Wing	Tail
19 ♂ ad.	89–94(91.9)	82–87(83 5)
7 ♀ ad.	82–89(85 9)	74–82(79 6)
5 ♂ juv.	82–89(85.2)	78, 82
3 ♀ juv.	80, 82, 86	

Range.—Northern Solomon Islands (Buka, Bougainville and Shortland Island).

When Rothschild and Hartert described this form, they did not have sufficient material, especially adult males. Thus, the main character (smaller size), as compared with *cockerelli*, does not hold.

However, there are some minor characters of coloration which enable us to distinguish the birds from the northern Solomon Islands as a separate subspecies.

Rhipidura cockerelli interposita Rothschild and Hartert

Rhipidura cockerelli interposita ROTHSCHILD AND HARTERT, 1916, Bull. Brit. Orn. Club, XXXVI, p. 73; Ysabel Island.

SUBSPECIFIC CHARACTERS.—Differs from *cockerelli* and *septentrionalis* in the greater extent of the white on the inner secondaries, which have the outer webs entirely, the inner largely (about half their length) white; very little or no white on the secondary coverts.

	WING	TAIL	WEIGHT
Choiseul Island			
18♂ ad.	88–91(89 2)	78–84(79 4)	16–19(17 3)
7♀ ad.	82–86(84 6)	75–81(78 3)	18 5, 19
3♂ juv.	79, 82, 84	75, 78, 79	
2♀ juv.	80, 81	78	
Ysabel Island			
4♂ ad.	88–93(91 0)	79–83(80 8)	
5♀ ad.	83–87(85 0)	75–80(77 0)	
1♂ juv.	83	78	
1♀ juv.	82		

RANGE.—Northern Solomon Islands (Choiseul and Ysabel Island).

The extension of white on the secondaries varies to some degree, but in the series the characters given by Rothschild and Hartert hold quite well.

Rhipidura cockerelli floridana, new subspecies

TYPE.—No. 217646, Amer. Mus. Nat. Hist.; ♂ ad.; Tulagi Island; May 23, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Intermediate between *interposita* and *cockerelli;* the white on the inner secondaries more restricted than in *interposita*, but not as much as in *cockerelli;* tip and inner edge of the three innermost secondaries largely white.

SPECIMENS EXAMINED.—Tulagi Island, 1♂; Florida Island 1♂, 1♀; compared with large series of *interposita* and *cockerelli*.

	WING	TAIL
2♂ ad.	93, 92	84, 85
1♀ ad.	84	80

Rhipidura cockerelli cockerelli (Ramsay)

Sauloprocta cockerelli RAMSAY, 1879, Proc. Linn. Soc. N.S.W., IV, p. 81; Lango, Guadalcanar.

SUBSPECIFIC CHARACTERS.—Upperside slate-black; white on inner secondaries restricted to the outer webs and tips of inner webs; white spots on breast medium-sized.

	WING	TAIL
14♂ ad.	89–95(91.7)	80–87(84.0)
9♀ ad.	82–86(84.8)	77–81(79.1)
4♂ juv.	84–87(85.5)	77–84(81.2)
2 ♀juv.	81, 82	77, 78

RANGE.—Guadalcanar Island, British Solomon Islands.

Rhipidura cockerelli coultasi, new subspecies

TYPE.—No. 226926, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; April 8, 1930; W. F. Coultas and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Very different from *cockerelli;* larger, back gray, not black, inner secondaries brownish black, with a very narrow whitish edge; lower throat white, not black; drop-shaped spots on the breast larger.

ADULT (male and female).—Forehead, crown, neck, lores, upper cheeks, ear-coverts and sides of neck black; scapulars and back dark gray, lighter toward the rump; upper tail-coverts dusky gray with blackish edges; chin black, feathers of upper throat with narrow white tips; lower throat white; breast-feathers black with large drop-shaped white spots; belly, flanks and under tail-coverts white; thighs blackish; axillaries and under wing-coverts dark grayish with white tips; wing and tail blackish; outermost tail-feather with whitish tip; wing-coverts with narrow pale tips; innermost secondaries with narrow whitish edge; exposed culmen, 15–16; bill (from nostril), 12; tarsus, 16–17 mm.

	WING	TAIL	WEIGHT
♂ ad.	94–99(96.0)	87–96(91.0)	20 –22 (21.0)
♀ ad.	88–93(90.3)	82–90(86.9)	18.5–21.5(20.2)
♂ juv.	92, 93	91, 91	20.5, 24.5
♀ juv.	85–91(89.2)	85, 86, 87	19 –23 (20.5)

Most birds (coll. January to April) are in fresh plumage or just completing their molt.

RANGE.—Malaita Island, British Solomon Islands.

This very distinct subspecies shows several peculiarities not found in any of the other forms of the species.

Rhipidura cockerelli albina Rothschild and Hartert

Rhipidura albina ROTHSCHILD AND HARTERT, 1901, Nov. Zool., VIII, p. 183; Kulambangra Island.

Rhipidura cockerelli albina ROTHSCHILD AND HARTERT, 1916, Bull. Brit. Orn. Club, XXXVI, p. 73.

SUBSPECIFIC CHARACTERS.—Similar to *cockerelli*, but breast almost uniformly black, only on lower edge with narrow (or sometimes drop-shaped) white shaft stripes; back slaty black; white edges on secondaries narrower; outermost tail-feather usually with whitish spot on the tip; larger; many specimens of this subspecies have a pale ochraceous tinge on the white edges of the secondaries.

	Wing	Tail
Kulambangra		
7♂ ad.	90–97(93 6)	83–89(86.4)
2♀ ad.	90, 91	84, 84
1♂ juv.	85	
2♀ juv.	84, 90	80, 84
New Georgia		
16♂ ad.	89–96(91.0)	81–87(83.5)
5♀ ad.	85–87(86.2)	78–83(80.8)
3♂ juv.	83, 84, 86	79, 82, 82
1♀ juv.	80	79
Vangunu		
12♂ ad.	90–96(93.5)	83–87(85.5)
3♀ ad.	86, 87, 88	78, 83, 83
Rendova		
9♂ ad.	88–95(91.4)	82–87(84.7)
3♀ ad.	86, 88, 88	80, 82, 82
Tetipari		
3♂ ad.	89, 91, 93	84, 86, 86
3♂ ad.	84, 87, 88	80, 81, 81
1♀ juv.	86	80

RANGE.—Eastern part of central group of the Solomon Islands (Kulambangra, New Georgia, Vangunu, Rendova and Tetipari Island).

This subspecies was originally described as a species belonging to the *Sauloprocta*-section of the genus *Rhipidura*, but this error was corrected later by the authors (1916) and the bird properly placed as representative of *cockerelli*. Of this subspecies there were, so far as known, only four specimens in the Tring Museum, the type and three birds from Rendova. Rothschild and Hartert consider the possibility that the Rendova birds belong to a smaller subspecies, as the three specimens from that locality revealed considerably smaller measurements than the type from Kulambangra. To show that this supposed difference is only very slight, I give, in full, the measurements of the Whitney series from the five islands of its range. The whitish line along the tip of the outermost tail-feather is not peculiar to Rendova birds, but also found in a good many specimens from other islands. However, specimens from Rendova and Tetipari have the lower breast more strongly spotted, on the average, than birds from Kulambangra. But, as there is a great deal of individual variation (most specimens can not be identified without questioning the label), and as the Vangunu and New Georgia specimens are intermediate, I do not venture to separate the specimens from Rendova and Tetipari Islands as a different subspecies.

There seems to be a tendency toward albinism in the species

Rhipidura cockerelli. Rothschild and Hartert described it from the type of *albina,* but I have seen specimens with a few white feathers on head and hindneck in most of the subspecies.

Rhipidura cockerelli lavellæ Rothschild and Hartert

Rhipidura cockerelli lavellæ ROTHSCHILD AND HARTERT, 1916, Bull. Brit. Orn. Club, XXXVI, p. 74; Vella Lavella Island.

SUBSPECIFIC CHARACTERS.—Similar to *cockerelli,* but white spots on the breast smaller; back grayish, but not quite so light as in *coultasi;* white edges to the secondaries narrower.

	WING	TAIL
Vella Lavella		
16 ♂ ad.	89–93(90.4)	80–86(82.8)
10 ♀ ad.	84–88(85.4)	78–83(80.0)
3 ♂ juv.	81, 85, 85	77, 80, 80
Ganonga		
2 ♂ ad.	89, 90	80, 81
1 ♀ ad.	87	80
3 ♂ juv.	81, 82, 84	80, 80

RANGE.—Western part of central group of the Solomon Islands (Vella Lavella and Ganonga).

All the specimens (coll. October and November) are either worn or have begun their molt, which seems to take place mainly from November to January in all the subspecies of this species, although single molting birds can be found during any month.

The birds from Ganonga Island do not seem to be quite identical with Vella Lavella birds. The back is slightly darker, the white spots on the breast smaller, and the black on breast and flanks more extended. My material is too limited to decide whether this difference is of any systematic value.

SUPERSPECIES *Rhipidura spilodera*

This superspecies contains several representative forms that are fairly similar in the eastern part of the range, so that they may safely be considered as subspecies. In the west, especially on the mountains of the Solomon Islands, these forms have developed a definitely different appearance so that they are better kept as representative species. Furthermore, some of them, as *rennelliana,* inhabit low coral islands, while others, as *drownei,* are found only on higher mountain ranges. Most of the forms are found both in the lowland and on mountains, but only on larger islands with considerable elevations.

I regard four species as members of the superspecies *Rhipidura spilodera: Rhipidura spilodera, Rhipidura rennelliana, Rhipidura drownei,* and *Rhipidura tenebrosa.*

Rhipidura spilodera Gray

RANGE.—Fiji Islands, Banks Group, New Hebrides, and New Caledonia.

Rhipidura spilodera rufilateralis Sharpe

Rhipidura rufilateralis SHARPE, 1879, 'Cat. Birds Brit. Mus.,' IV, p. 337; Taviuni Island. For:

Rhipidura albicollis E. L. LAYARD, 1876, Ibis, p. 149; Taviuni Island (*nomen nudum*).

SUBSPECIFIC CHARACTERS.—Head darker and duller than back, spotting of the breast reduced, spots rufous brown, not grayish; flanks and sides of breast strongly washed with rufous.

	WING	TAIL
6♂ ad.	77–80(78.3)	80–81(80.5)
8♀ ad.	74–80(76.5)	77–81(79.6)
2♂ juv.	72, 73	

These specimens were collected in December and are either molting or very worn.

RANGE.—Taviuni Island, Fiji Group.

Rhipidura spilodera erythronota Sharpe

Rhipidura erythronota SHARPE, 1879, 'Cat. Birds Brit. Mus.,' IV, p. 337; Vanua Levu Island (Fiji).

SUBSPECIFIC CHARACTERS.—Back and rump very rufous, strongly contrasting against the fuscous head; breast spotted with grayish brown; belly and flanks buffy.

	WING	TAIL
Vanua Levu (Dec., 1924, Jan., 1925)		
7♂ ad.	79–85(81.7)	82–86(85.2)
1♀ ad.	78	82
6♂ juv.	69–77(73.0)	73–84(80.0)
3♀ juv.	72, 73, 74	78, 79, 82
Yanganga Island (Jan., 1925)		
2♂ ad.	76, 77	79, 79
1♀ ad.	72	78
2♀ juv.	69, 71	78, 79
Kio Island (Dec., 1924)		
1♀ ad.	79	83

Birds from Yanganga Island (on the northeast coast of Vanua Levu) average smaller than typical *erythronota,* but agree in coloration. The material is not sufficient to warrant a separation.

RANGE.—Vanua Levu and neighboring islands, Fiji Group.

Rhipidura spilodera layardi Salvadori

Rhipidura layardi Salvadori, 1877, Ibis, p. 143. New name for:

Rhipidura albogularis Layard, 1875, Proc. Zool. Soc. London, p. 29; Ovalau Island (Fiji). Preoccupied by

Muscicapa (*Muscylva*) *albogularis* Lesson, 1832, in Belanger, 'Voy. Ind. Orient.,' p. 264 = *Rhipidura albicollis* Vieillot.

Subspecific Characters.—Breast feathers with broad, blackish shaft-stripes, back dull grayish-brown, not sharply contrasting against the head.

	Wing	Tail
Ovalau Island		
1 ♂ ad.	82	87
1 ♀ ad.	76	81
1 ♀ juv.	75	82
Viti Levu Island		
9 ♂ ad.	79–83(80.9)	80–89(84.3)
11 ♀ ad.	75–79(77.3)	77–85(81.4)
2 ♂ juv.	73, 77	77, 81
2 ♀ juv.	76, 77	82, 85

There is no difference between specimens from Ovalau and Viti Levu.

Range.—Ovalau Island and Viti Levu, Fiji Group.

Rhipidura spilodera spilodera Gray

Rhipidura spilodera G. R. Gray, 1870, Ann. Mag. Nat. Hist., (4) V, p. 330; Vanua Lava, Banks Islands.

Rhipidura sancta Sharpe, 1899, Bull. Brit. Orn. Club, X, p. 29 (also 1900, Ibis, p. 364); Espiritu Santo, New Hebrides.

Subspecific Characters.—White feathers of breast with large triangular spots; back dusky olive-cinnamon brown, more rufous toward the rump; belly buffy; wing-coverts without white tips; white edges of outer tail-feathers gradually merging into the grayish centers.

		Wing	Tail		Wing	Tail
New Hebrides						
Efate	♂	82–85(83.3)	90–95(92.5)	♀	75–81(78.0)	85–93(89.2)
Mai	♂	80–86(83.8)	91–95(93.3)	♀	78–79(78.5)	90–94(91.2)
Tongariki	♂			♀	80	91
Tongoa	♂	83	93	♀	76, 77, 80	88, 91
Epi	♂	81, 85	90, 93	♀	76, 79	87, 90
Pauuma	♂	83	90	♀	78–80(79.3)	88, 89, 92
Malekula	♂	80–86(83.3)	87–94(90.8)	♀	75–80(77.8)	87–91(89.0)
Ambrym	♂	83	90	♀	75	87
Pentecost	♂			♀	79, 79	91, 93
Aoba	♂	82, 82, 82		♀	79	
Santo	♂	79–82(80.5)	85–91(88.2)	♀	74–79(76.3)	84–89(86.6)
Banks Islands						
Gaua	♂	81–85(82.6)	87–90(88.4)	♀	75–80(77.8)	85–89(86.6)
Vanua Lava	♂	81–87(83.5)	88, 82, 96	♀	78–80(79.0)	87, 87, 90

Range.—New Hebrides and Banks Group (above-listed islands).

The birds from the thirteen listed islands do not form an entirely uniform population. Specimens from the southern islands (Efate, etc.) as compared with topotypical *spilodera* tend to have the belly more richly washed with ochraceous buff, the back of a warmer cinnamon, and the breast of a lighter appearance due to broader white edges on the feathers. Single specimens can not be classified, but in the series a slight difference is apparent. Specimens from Santo Island (type locality of *sancta* Sharpe) are intermediate. Most of the differences just described seem to have been caused by wear. The Whitney specimens from the Banks Islands and northernmost New Hebrides were collected late in the season (Nov.–Jan.) and the buff of the belly has bleached while the white tips of the breast-feathers have been partially worn off. The birds from Efate and the other southern islands were collected from June to August and are therefore in fresh plumage.

As both the types of *spilodera* and *sancta* are in the British Museum, I sent part of our own series to Mr. N. B. Kinnear. I am greatly indebted to him for the following extensive notes, which he gave me concerning the British Museum material:

1 ♂ Espiritu Santo, Sept. 17, 1899
1 ♀ " " " " "

These two birds agree very closely with your male and female from Santo, Sept. 1st, Nos. 213980 and 213983, and practically the only difference that strikes one is the color of the belly which seems rather darker; that, I think, is due to the fact that our birds are not such well-made skins as yours and have less stuffing in them; the buff feathers on the flanks show up on the belly and give the darker appearance.

I do not know why Sharpe compared these birds with *verreauxi*, as we had the type of *spilodera* to compare them with when he described *sancta*. Partly on account of the make-up, the type of *spilodera* has a very dark appearance on the under side, the breast being stuffed out and bunched up towards the throat, exposing the dark centres of the feathers. It agrees best with your Vanua Lava skin No. 210390, but the white is rather discolored and dirty. Individual feathers on the breast do not appear to have much less white than in your Santo birds but, owing to the discolouration and over-stuffing, appear darker.

The amount of black showing on our two Santo birds is no more, for instance, than is found on your two Vanua Lava birds, Nos. 215810 and 215805, but the belly is distinctly more ochraceous buff.

On the other hand, our single skin from Vanua Lava (August) is no darker than your Santo bird (August), No. 213986. I should therefore, even with these slight differences, be inclined to sink *sancta*.

Rhipidura spilodera verreauxi Marie

Rhipidura verreauxi Marie, 1870, Actes Soc. Linn. Bordeaux, XXVII, p. 326; New Caledonia. [Type examined, No. 7896, Amer. Mus. Nat. Hist., ex Verreaux Coll.]

SUBSPECIFIC CHARACTERS.—Similar to *spilodera*, but white edges of feathers on breast much narrower; back more rufous; wing-coverts with white tips.

RANGE.[1]—New Caledonia and (?) Loyalty Islands.

Rhipidura rennelliana Mayr

Rhipidura rennelliana MAYR, 1931, Amer. Mus. Nov it. No. 486, p. 25; Rennell Island.

SPECIFIC CHARACTERS.—Uniformity of coloration; all distinct marks of the related species (as white supraloral spot, white throat, dark drop-like spots on the breast and white tips on the wing-coverts) only indicated.

RANGE.—Rennell Island.

For details see original description.

Rhipidura drownei, new species

SPECIFIC CHARACTERS.—White supraloral spot well developed; throat whitish; breast mottled; central tail-feathers uniformly colored, outer with light edges.

RANGE.—Mountains of Bougainville and Guadalcanar, Solomon Islands.

This species is somewhat similar to *Rhipidura rennelliana*, but on account of the morphological differences and the different habitat it seems to be safer to regard it as specifically different.

Rhipidura drownei drownei, new subspecies

TYPE.—No. 225358, Amer. Mus. Nat. Hist.; ♂ ad.; Bougainville Island, Solomon Islands; Jan. 5, 1928; F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Plumage of back, wings, tail, breast and belly washed with ochraceous buff; postocular stripe only indicated by a few white feathers; wing-coverts with broad buffy or ochraceous tips.

ADULT (male and female).—Crown dark mouse-gray (R.LI), sides of head lighter; part of forehead, supraloral region and superciliary stripe white; scapulars and back dusky olive-brown, lighter and more brownish toward the rump; feathers of chin, throat and lower cheeks white with gray bases, on lower throat with buffy gray bases; centers of breast-feathers grayish hair-brown with narrow buff edges which almost disappear on the side of the breast; middle of the abdomen pinkish buff (R.XXIX), flanks buffy gray; under tail-coverts dull cinnamon-buff; thighs gray, feathers with buffy tips; axillaries with grayish bases and broad buffy tips; wing-feathers brown, coverts darker; primaries, except the two outer ones, with dark cinnamon edges on the outer web; edges and tips of secondaries similar, but brighter; greater upper wing-coverts with large, middle upper wing-coverts with smaller buffy-cinnamon tips; upper tail-coverts snuff-brown (R.XXIX); central tail-feathers hair-brown with a light olive tinge and without any light edges or tips; second to fifth tail-feathers with increasing extension of light pinkish-cinnamon (R.XXIX) on tip and inner web;

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[1] For details see Sarasin, 1913, 'Die Vogel Neu-Caledoniens,' p. 19.

outermost tail-feather similar, but outer web entirely pinkish buff; shaft of the outermost tail-feather buffy cinnamon, on the other tail-feathers more brownish.

JUVENAL.—Similar to adult, but feathers more fluffy; light edges of wing-feathers and coverts broader.

Iris brown, bill blackish, lower mandible whitish with brown tip, feet brown. Bill, 8–9 mm.; tarsus, 17–19 mm.

	WING	TAIL
♂ ad.	75–80 (77.3)	76–80 (78.1)
♂ juv.	66–75 (72.0)	74, 77, 77
♀ ad.	70–71 (70.5)	73–79(76.4)

RANGE.—Mountains of Bougainville Island, Solomon Islands.

I name this interesting new species in honor of the late Dr. Frederick P. Drowne, who was the leader of the party of the Whitney South Sea Expedition that successfully explored the mountains of Bougainville Island.

Rhipidura drownei ocularis, new subspecies

TYPE.—No. 217672, Amer. Mus. Nat. Hist.; ♂ ad.; Guadalcanar Island, British Solomon Islands; July 25, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Similar to *drownei*, but without the cinnamon-buff of underside and tail; distinct white postocular stripe; supraloral spot larger and throat purer white; edges of the feathers on breast and abdomen very pale buffy or whitish; back and edges of wing-feathers less rufescent; tips and edges of the tail-feathers whitish; tips on wing-coverts much reduced.

	WING	TAIL
13♂	71–77(73.1)	72–81(76.1)
6♀	66–70(68.0)	73, 78

RANGE.—Mountains of Guadalcanar Island, British Solomon Islands.

Rhipidura tenebrosa Ramsay

Rhipidura tenebrosa RAMSAY, 1882 (March 20), Proc. Linn. Soc. N.S.W., VI, 1881, p. 835; Wannu, San Cristobal.

SPECIFIC CHARACTERS.—Large; under- and upperside brownish; supraloral and postocular stripe indicated by a few white feathers. Tips of feathers on throat and lower cheeks white; wing-coverts with broad cinnamon tips; tail-feathers (except central pair) with broad, sharply defined, white tips; outer web of outermost tail-feather only white in lower part.

Iris brown, bill above black, lower mandible whitish with gray tip; feet bluish gray.

Bill, 11–12 mm.; tarsus, 21–22 mm.

	WING	TAIL	WEIGHT
5♂ ad.	85–89(86.8)	89, 91, 93	18.5
4♂ juv.	77–84(81.3)	87, 89	17–18(17.5)
9♀ ad.	76–80(78.2)	84–88(85.8)	15–17(15.7)
1♀ juv.	77	80	

RANGE.—San Cristobal Island, British Solomon Islands.

Specimens collected in April, 1927, are in fresh plumage, those collected in December, 1929, are all in molt.

Thus far, this bird has been considered a very rare species, as only one specimen had been collected (by Meek) since its discovery.

Rhipidura nebulosa Peale

RANGE.—Samoa Islands.

This species is probably another member of the superspecies *Rhipidura spilodera.* However, it has acquired so many distinct characters that it may be more correct not to include it in the *spilodera* group.

Rhipidura nebulosa nebulosa Peale

Rhipidura nebulosa PEALE, 1848, 'U. S. Explor. Exped.,' Birds, p. 99; Upolu, Samoa.

Rhipidura fuscescens CABANIS AND REICHENOW, 1876, Journ. f. Orn., p. 319; (Segaar Bay, New Guinea, error for) Upolu, Samoa (see Salvadori, 1877, Proc. Zool. Soc. London, p. 194, and 1889, 'Forschungsreise Gazelle,' III, p. 279).

	WING	TAIL
11 ♂ ad.	73–76(74.5)	78–84(80.1)
7 ♀ ad.	71–72(71.5)	75–79(77.2)

RANGE.—Upolu Island, Samoa Islands.

Rhipidura nebulosa altera, new subspecies

TYPE.—No. 206063, Amer. Mus. Nat. Hist.; ♂ ad.; Savaii Island, Samoa; May 9, 1924; R. H. Beck.

SUBSPECIFIC CHARACTERS.—Similar to *nebulosa,* but lighter, white marks more pronounced; the white postocular stripe broader and longer; the white supraloral spot more pronounced; most specimens with a distinct whitish throat which is exceptional in *nebulosa;* buffy area on lower belly more extended; white margins on the tail-feathers broader; smaller.

	WING	TAIL
9 ♂ ad.	71–75(72.4)	77–82(79.4)
1 ♂ juv.	73	79
8 ♀ ad.	67–74(71.6)	76–80(77.8)
3 ♀ juv.	66, 71, 72	75, 77

RANGE.—Savaii Island, Samoa Islands.

Rhipidura flabellifera Gmelin

RANGE.—Australia, Tasmania, New Zealand Group, New Caledonia Group, New Hebrides, Banks Islands and San Cristobal (Solomon Islands).

Rhipidura flabellifera brenchleyi Sharpe

Rhipidura brenchleyi SHARPE, 1879, 'Cat. Birds Brit. Mus.,' IV, p. 311; Aneiteum, New Hebrides.

Rhipidura erromangæ SHARPE, 1900, Ibis, p. 340; Erromanga Island, New Hebrides.

SUBSPECIFIC CHARACTERS.—Apparently very similar to *bulgeri*, but ochraceous buff of belly lighter, shafts of central tail-feathers sometimes brownish, not always pure white.

I have seen no material of *bulgeri* and neither Sharpe, in his original description, nor any other author since gives any distinctive characters. The coloring of the shaft of the central tail-feathers varies individually and is not always brown in *brenchleyi* as stated by Sharpe.

		WING	TAIL		WING	TAIL
Efate	♂[1]	70–73(71.6)	76–78(76.6)	♀[1]	64–69(67.5)	68–74(71.5)
Leleppa	♂	72	79	♀	67	74
Mai	♂	72, 75	76, 78	♀	66, 69	73, 75
Tongariki	♂	73, 74	78, 79	♀	69	76
Tongoa	♂	74	77	♀	68, 68, 68	75, 75, 76
Lopevi	♂	73	77	♀	66, 68, 69	70, 74, 76
Ambrym	♂	73, 74	77, 79	♀	67	71
Santo	♂	69–73(71.3)	75–76(75.4)	♀	66–69(67.6)	73, 74, 75
Meralav	♂	73, 73, 74	77,80	♀	67–70(68.6)	74–77(75.2)
Gaua	♂	71–74(72.4)	76–78(77.0)	♀	67–70(68.1)	74–77(75.2)
Vanua Lava	♂	70–75(72.2)	76–79(77.2)	♀	67–69(67.6)	73–75(74.3)
Valua	♂	71, 71, 72	76, 79	♀	69, 70	73, 75
Bligh	♂	71	76	♀	66	
San Cristobal	♂	67, 68, 71	75	♀	65	75

RANGE.—New Hebrides, Banks Islands, and San Cristobal (Solomon Islands).

This bird not only varies a great deal individually, but also changes its appearance considerably during the season. Freshly molted birds have the underside tinged with a warm ochraceous-buff which bleaches to pale buff later in the season, while the upperside gets a brownish tinge due to wear. Two specimens collected in December (1926) on Leleppa Island (near Efate) differ strikingly from the rest of the Efate series, which was collected in June and July. The Leleppa birds agree in every detail with Banks Islands birds which (mostly collected in November) are also worn and faded.

From scanty material Sharpe described in 1900 the fantail from Erromanga Island. As the Whitney Expedition has not collected on the three southern islands of the New Hebrides, and as the distinguishing characters mentioned by Sharpe in the original description are such that are very apt to vary individually, I sent part of our series to Mr. N. B. Kinnear. After a comparison of our material with that of the British Museum (including the types of *brenchleyi* and *erromangæ*), he wrote me the following notes, for which I am greatly indebted:

---

[1] As the sexing of some specimens is not correct, it is possible that the measurements of males and females do not overlap actually.

> We have three skins from Aneiteum:—
> 1 ♂ collected by Brenchley in August, 1865
> 2 ♀ " " " " " "
> 3? " " MacGillivray in June, 1859.
>
> No. 2 is considerably darker below than No. 1 and agrees with No. 3 in the richer colour on the underside.
>
> From Erromanga we have:—
> 4 ♂ collected by Capt. A. M. Farquhar on May 28, 1899
> 5? " " " " May 26, 1899
>
> These two birds are slightly paler on the under surface than No. 3, Aneiteum, June, and in fact are intermediate between the two dark Aneiteum specimens, Nos. 2 and 3, and the other Aneiteum bird, No. 1.
>
> In regard to the white on the tail, this is very distinct in the Erromango birds (Nos. 4 and 5), on the three outer tail feathers, because the color is a pure white and not a brownish white as in Aneiteum (Nos. 1, 2, and 3) birds. I do not, however, think this is of much account.
>
> Comparing the above June and August birds from Aneiteum and Erromango with your series from Efate I find that the upper surface of the latter has slightly more gray and the former have a browner tinge. This may perhaps be due to the age of the skins.
>
> On the under side Nos. 2, 3, 4, and 5 are distinctly richer and darker than Efate birds, but No. 3 is only slightly darker.
>
> As regards Tanna we have only two skins. One has been in spirit, so is of no account, and the other is only very slightly darker than your Efate skin No. 212509, July 15.
>
> I do not think the Efate and Banks Islands birds can be kept separate, and I agree with you that the best course is to treat *erromangæ* as a synonym of *brenchleyi* and make all the New Hebrides and Banks Islands birds one subspecies.

It was a surprising discovery to find this race in the mountains of San Cristobal Islands (British Solomon Islands). The four specimens collected (Dec., 1929) are partly very worn, partly in molt. A series of fresh birds must be collected before anything can be said about the distinguishing characters of the San Cristobal birds.

Rhipidura personata Ramsay

Rhipidura personata Ramsay, 1876, Proc. Linn. Soc. N.S.W., I, p. 43; Kandavu Island, Fiji Group.

Specific Characters.—Large, with a strong bill; black band across the lower throat not forming a straight line, but triangular-shaped with the point toward the chin; sides of breast cinnamon, rest of underside whitish; tail-feathers brownish black, outer tail-feathers with white tips; the outermost has a narrow white edge on the outer web; shafts of all tail-feathers brownish black, except on the outermost, where it is half brown and half white.

	WING	TAIL		WING	TAIL
11♂	79–84(81.2)	86–91(89.2)	8♀	74–78(76.0)	84–87(85.8)

RANGE.—Kandavu Island, Fiji Group.

This species resembles *Rhipidura flabellifera* somewhat, but by no means is it certain that it is a representative of it. In other respects it has several features in common with *Rhipidura rufifrons*, and it is therefore necessary to treat this very distinct bird as a separate species. It is found only on Kandavu Island in the Fiji Group.

SUPERSPECIES *Rhipidura rufifrons*

This bird varies geographically more than any other *Rhipidura*, but, as much as I would like to do it, I cannot give a complete revision of the more than thirty representatives, as I have no adequate material from the islands west of New Guinea. Several of the representatives, as *Rhipidura matthiæ* Heinroth and *Rhipidura dahli* Reichenow, have acquired very distinct characters, and it may be safer to regard them as species of the superspecies *rufifrons*. Others, as *Rh. melanolæma* Sharpe and *Rh. kubaryi* Finsch, I would not give more than subspecific rank.

The following revision restricts itself to those places from which I have sufficient material; that is, the Santa Cruz Group and the Solomon Islands.

Rhipidura rufifrons Latham

RANGE.—From Australia to the Santa Cruz Group and Solomon Islands in the east, Micronesia (Carolines and Mariannes) in the north and to the Moluccas, Lesser Sunda Islands and Celebes in the West.

In the Santa Cruz Group and the Solomon Islands the following subspecies can be distinguished.

Rhipidura rufifrons melanolæma Sharpe

Rhipidura melanolæma SHARPE, 1879, 'Cat. Birds Brit. Mus.,' IV, p. 313; new name for:

Muscylva pectoralis PUCHERAN, 1853, 'Voy. Pôle Sud,' Zool., III, p. 75; Vanikoro Island, Santa Cruz Group. [and not: *Leucocirca pectoralis* Jerdon, 1843, 'Illustr. Ind. Orn.,' pt. 1, text to plate II. =*Rhipidura pectoralis* Jerdon].

Rhipidura astrolabi OUSTALET, 1881, Bull. Soc. Philom., (7) V, No. 2, p. 76; Vanikoro Island, Santa Cruz Group.

SUBSPECIFIC CHARACTERS.—Forehead and supercilium white, not rust-colored;

chin and upper throat black; rump more or less of the color of the back, not rusty; belly, flanks and under tail-coverts whitish.

Immature.—Similar to adult, but distinguishable by the softer plumage, the more soot-colored, instead of pure black throat, the rusty edges of the wing-coverts and the bright rust-colored feather-tips on the rump; some of the young birds have a whitish throat, which is another proof of the relationship to the white-throated representatives.

	Wing	Tail
♂ ad.	70–74(71.8)	79–84(82.5)
♂ juv.	67, 68, 69	77, 80, 83
♀	65–71(67.8)	76–81(79.1)

Range.—Vanikoro Island, Santa Cruz Group.

This bird and *utupuæ* are rather similar to *Rhipidura rufifrons kubaryi* from the Caroline Islands.

Rhipidura rufifrons utupuæ, new subspecies

Type.—No. 213917, Amer. Mus. Nat. Hist., ♂ ad.; Utupua Island, Santa Cruz Group; September 28, 1926; R. H. Beck and J. G. Correia.

Subspecific Characters.—Very similar to *Rhipidura rufifrons melanolæma*, but lower mandible black, not flesh-colored; black of upper breast reaching farther down; white on forehead, supraloral and supraocular region more extended; head and back more rusty, lacking the olive-gray tinge of *melanolæma* (the difference being about as between bister and sepia, R.XXIX); larger (see measurements); tarsus, 21–22 mm.; "iris brown, bill black, feet brown."

	Wing	Tail
4♂ ad.	76–79(77.8)	87–90(88.5)
4♂ juv.	67–72(70.0)	81–85(83.0)
4♀ ad.	71–72(71.5)	84–85(84.5)
2♀ juv.	66, 67	77, 79

Range.—Utupua Island, Santa Cruz Group.

Rhipidura rufifrons agilis, new subspecies

Type.—No. 217529, Amer. Mus. Nat. Hist.; ♂ ad.; Santa Cruz Island, Santa Cruz Group; February 24, 1927; R. H. Beck and F. P. Drowne.

Subspecific Characters.—Very different from *melanolæma*, and more approaching the representatives of this species on the Solomon Islands; forehead tawny (R.XV); chin, lower cheeks and region below the ear-coverts white (feathers with black bases); upper tail-coverts and base of tail-feathers (except the two outer) pale hazel (R.XIV); under tail-coverts ochraceous.

Adult.—Forehead and supraocular line tawny; lores, upper cheeks, circumocular space and ear-coverts black; chin, lower cheeks and region below the ear-coverts white, separating the black ear-coverts from the black lower throat and upper breast; feathers on the lower margin of the black breast-shield with white edges; lower breast and belly white, feathers with black bases; flanks gray with pale ochraceous feather tips; under tail-coverts pale ochraceous; thighs dark gray; upperside hair-brown (XLVI), lighter toward the rump; pileum with dark centers; upper tail-coverts and base of the tail-feathers pale hazel; axillaries grayish with white tips; wing-feathers dark brown; wing-coverts and secondaries with hair-brown edges; tail (except base) blackish; central tail-feathers narrowly, outer broadly tipped with white.

Juvenal.—Smaller, plumage softer; all colors duller, especially forehead and upper tail-coverts; feathers on lower back and wing-coverts with rusty tips.

	Wing	Tail
9 ♂ ad.	70–72(70.7)	72–78(75.0)
2 ♂ juv.	67, 69	74, 74
8 ♀ ad.	65–68(66.9)	70–74(72.4)
1 ♀ juv.	66	69

Range.—Santa Cruz Island, Santa Cruz Group.

In the Solomon Islands, *Rhipidura rufifrons* was collected by the Whitney South Sea Expedition on twenty-four islands where it divides up into seven subspecies.

Rhipidura rufifrons russata Tristram

Rhipidura russata Tristram, 1879 (October), Ibis, p. 440; Makira Harbour, San Cristobal Island.

Subspecific Characters.—Entire back bright cinnamon-rufous; black collar across the throat narrow.

	Wing	Tail	Weight
14 ♂ ad.	66–70(67.9)	70–77(73.6)	9.5–10
4 ♂ juv.	61–64(63.3)	68–73(71.0)	8.5
3 ♀ ad.	64, 65, 65	73, 74	
3 ♀ juv.	64, 65, 65	70, 70, 72	

Range.—San Cristobal Island, British Solomon Islands.

Rhipidura rufifrons kuperi, new subspecies

Type.—No. 217567, Amer. Mus. Nat. Hist.; ♂ ad.; Awa Raha or Santa Anna Island, British Solomon Islands; March 9, 1927; R. H. Beck and F. P. Drowne.

Subspecific Characters.—Similar to *russata* Tristram, but coloration of the back deeper and more dusky, washed with the hair-brown of the neck; the hair-brown of the hindneck gradually merging into the cinnamon-rufous of lower back and rump, not sharply separated from it as in *russata;* rusty area on forehead more extended.

	Wing	Tail
6 ♂ ad.	68–72(69.4)	73–79(76.2)
2 ♂ juv.	64, 65	71, 72
3 ♀ ad.	66, 66, 67	73, 77
2 ♀ juv.	62, 65	

Most specimens (coll. December, 1929) badly molting.

Range.—Santa Anna Island, British Solomon Islands.

I name this interesting new bird in honor of our host, Mr. Henri

Kuper, who gave us every assistance and helped to make our exploration of Santa Anna Island successful.

Rhipidura rufifrons ugiensis, new subspecies

TYPE.—No. 217586, Amer. Mus. Nat. Hist.; ♂ ad.; Ugi Island, British Solomon Islands, April 13, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Similar to *kuperi*, but chin and upper throat black as lower throat; cinnamon-rufous of lower back and rump paler; ear-coverts more brownish; white tips of tail-feathers broader; flanks darker, only the center of the belly being white; larger.

	WING	TAIL
7 ♂ ad.	70–72(70.7)	73–82(77.0)
1 ♂ juv.	67	
4 ♀ ad.	67–69(68.2)	76, 76, 77

RANGE.—Ugi Island (near San Cristobal), British Solomon Islands.

It is interesting to find in the Solomon Islands a subspecies that is black-throated as *melanolæma* of the Santa Cruz Group.

Rhipidura rufifrons rufofronta Ramsay

Rhissidura rufofronta RAMSAY, 1879 (June 5), Nature, XX, p. 125; Guadalcanar Island.

Rhipidura rubrofrontata RAMSAY, 1879 (June 16), Proc. Linn. Soc. N.S.W., XIV, p. 82; Guadalcanar Island.

SUBSPECIFIC CHARACTERS.—Ear-coverts blackish brown, only the very base of the tail-feathers rufous.

	WING	TAIL
5 ♂ ad.	72–77(74.2)	80–86(83.2)
2 ♂ juv.	70	80, 83
1 ♀ ad.	69	78

RANGE.—Guadalcanar Island, British Solomon Islands (coll. May and July, 1927).

Rhipidura rufifrons brunnea, new subspecies

TYPE.—No. 226950, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; H. Hamlin, W. F. Coultas, and W. F. Eyerdam.

SUBSPECIFIC CHARACTERS.—Similar to *rufofronta*, but darker and more brownish above; ear-coverts more blackish.

	WING	TAIL	WEIGHT
15 ♂ ad.	72–77(74.7)	80–86(83.5)	11.5–14(13.2)
5 ♀ ad.	69–76(72.4)	77–83(81.2)	12–14.5(13.5)
3 ♀ juv.	65, 69, 70	74, 77, 79	12, 13.5, 15.5

RANGE.—Malaita Island, British Solomon Islands.

Rhipidura rufifrons granti Hartert

Rhipidura rufifrons granti HARTERT, 1918, Bull. Brit. Orn. Club, XXXVIII, p. 60; new name for:

Rhipidura harterti OGILVIE-GRANT, 1915, Ibis, Supp. 2, p. 149; Rendova Island; not *Rhipidura flabellifera harterti* Mathews, 1912.

SUBSPECIFIC CHARACTERS.—Similar to *rufofronta,* but rufous-chestnut on tail more extended, covering the whole basal half; ear-coverts black, not brown.

	WING	TAIL
♂ ad.	72–78(75.9)	80–88(83.2)
♂ juv.	67–73(70.0)	80–81(80.6)
♀ ad.	71–75(73.1)	80–86(82.8)
♀ juv.	66–75(70.8)	76–84(79.8)

RANGE.—Central Solomon Islands (Vella Lavella, Ganonga, Bagga, Narovo, Gizo, Kulambangra, New Georgia, Gatukai, Rendova, and Tetipari).

There are no differences between the birds from the different islands of the central group.

Rhipidura rufifrons commoda Hartert

Rhipidura rufifrons commoda HARTERT, 1918, Bull. Brit. Orn. Club, XXXVIII, p. 60; Bougainville Island.

SUBSPECIFIC CHARACTERS.—Differs from *granti* by having the ear-coverts brown and by being smaller; differs from *rufofronta* by having nearly the basal half of the middle tail-feathers rufous as in *granti*, in having the rufous color on the back extending farther upward, and in being lighter on the upperside.

	WING	TAIL
♂ ad.	68–74(71.7)	76–83(80.2)
♂ juv.	68–70(68.8)	73–80(77.2)
♀ ad.	67–72(69.0)	73–79(76.6)
♀ juv.	62–67(64.7)	70–77(73.7)

RANGE.—Northern Solomon Islands (Buka, Bougainville, Shortland, Fauro, Momalufu, Choiseul, Molakobi, Arnavon, and Ysabel).

Rhipidura malaitæ, new species

TYPE.—No. 226985, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; April 4, 1930; W. F. Coultas, H. Hamlin and W. J. Eyerdam.

ADULT (male and female).—Above and below more or less uniform cinnamon-rusty; forehead, superciliary and sides of the head rusty-tawny; lores paler, feathers with blackish shafts; crown and hindneck dusky, about Prout's Brown (R.XV); scapulars, back, rump, upper tail-coverts and tail russet-hazel; wing feathers and coverts blackish; basal half of outer webs of primaries like the back; outer web of wing-coverts of the same color; secondaries on inner and outer web broadly edged with russet, innermost secondaries only with black line along the shaft; underside paler, throat light ochraceous-buff; breast, abdomen, flanks and under tail-coverts pale ochraceous-tawny; under wing-coverts and axillaries of the same color, outer web of the latter grayish.

Juvenal.—Similar to adult but plumage softer; wing and tail shorter.

Iris red-brown, upper mandible bluish black, lower mandible whitish, feet black.

Culmen (from forehead), 13–14 mm., (exposed), 9–10 mm.; tarsus, 14–16 mm.

	Wing	Tail	Weight
♂ ad.	74–78(76.0)	69–76(71.9)	11.5–14.5(12.8)
♂ juv.	70, 74	65–71(69.0)	11.5–14.5(13.1)
♀ ad.	66–72(69.4)	66–72(68.7)	10.5–13 (11.6)
♀ juv.	66–69(67.2)	66, 67, 68	10–12 (11.0)

Range.—Mountains of Malaita (British Solomon Islands) between 2000 and 4000 feet.

This species has no close relatives and differs from all the other members of the genus not only by its coloration, but also by the proportions, the tail averaging shorter than wing.

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PŒCILIID FISHES OF THE GENUS *MOLLIENISIA* IN HISPANIOLA, WITH NOTICE OF A NEW *LIMIA* FROM THE SAMANÁ PENINSULA

BY GEORGE S. MYERS

In 1915, Nichols reported two pœciliid fishes from the Samaná Peninsula in Santo Domingo, the only members of the family yet known from the eastern end of the island. *Heterandria zonata* Nichols, from a creek near the railroad station at Sanchez, appears to be identical with *Limia heterandria* Regan, 1913, ascribed, though apparently erroneously, to La Guayra, Venezuela (see Myers, 1925).

Nichols' other species, from Samaná, was identified as *Heterandria versicolor* (Günther), but it certainly is not that form, which has been confused with others and is definitely known only from the western end of the island (Haiti). I have Nichols' material at hand and have compared it with specimens of *Limia versicolor*. Most of the Hispaniolan Limias are deep-bodied fishes and *versicolor* is one of this group. It differs from all the island species in the advanced anal of the female, the origin distinctly before the dorsal. Nichols' specimens represent a slender species in which the anal of the female originates slightly behind the dorsal. In the male the gonopodium is proportionally much longer than in *versicolor* and the least depth of the caudal peduncle is contained nearly twice in its length to the dorsal base instead of only about one and a third times. The fish is, indeed, nearer to the true *Limia dominicensis*, a much misunderstood species, but it is still more slender and has a considerably longer gonopodium.

The largest male (Nichols, 1915, Fig. 1) has barely reached adult size and its long gonopodium, although it appears to have attained its full length, is not differentiated sufficiently at the tip for the generic characters to be visible. However, there seems little likelihood of it being anything but a *Limia*. It agrees with none of the known pœciliids of the island and seems without doubt to represent an undescribed species. I propose that it be called **Limia nicholsi**, the name to rest for the present on Nichols' description and figures. A more extended description will be presented in a review of the fresh-water fishes of Hispaniola.

As holotype I select the figured male referred to above, A. M. N. H. No. 5239*a*. There are four paratypes: the female figured by Nichols (1915, Fig. 2) and three very small specimens. All five specimens were collected by Mr. F. E. Watson in the San Juan River (fresh water) at Samaná, Dominican Republic.

I am pleased to be able to associate with this interesting little fish the name of John Treadwell Nichols, my first teacher in ichthyology.

In closing, it may be remarked that neither *Pœcilia melanogaster* Günther nor *Platypœcilus dominicensis* Evermann and Clark seems to be synonymous with *Limia dominicensis* (Cuvier and Valenciennes). I have examined type specimens of all three. Evermann and Clark's species must stand as *Mollienisia dominicensis* (E. and C.) a most remarkable extension of the range of this mainland genus. The Hispaniolan species is confined to mountain streams in the Artibonite system in Haiti and in the mountainous regions of central Santo Domingo. The American Museum has a fine series obtained by Dr. G. K. Noble at Lo Bracita, Province of Pacificador, in the drainage system of the Rio Camu, a tributary of the Yuna. The little stream in which the fishes were collected is a series of cascades tumbling down over the south slope of Quita Espuela. Dr. Noble tells me that the fishes were very common and exceedingly tame. What appears to be the same species was obtained abundantly in the Artibonite drainage of Haiti, by Dr. Albert W. Herre in 1928.

REFERENCES

Evermann, B. W., and Clark, H. W.
1906. 'New Fishes from Santo Domingo.' Proc. U. S. Nat. Mus., XXX, pp. 851–855, Figs. 1–3.

Myers, G. S.
1925. 'Results of Some Recent Studies on the American Killifishes.' The Fish Culturist, Philadelphia, IV, No. 8, pp. 370-371.

Nichols, J. T.
1915. 'On *Heterandria zonata* sp. nov. and *Heterandria versicolor* (Günther) from the Island of Santo Domingo.' Bull. Amer. Mus. Nat. Hist., XXXIV, pp. 603–604, Figs. 1–3.

Regan, C. T.
1913. 'A Revision of the Cyprinodont Fishes of the Subfamily Pœciliinæ.' Proc. Zool. Soc. London, 1913, pp. 977–1018, Text-figs. 168–173, Pls. xcix–ci.

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION XVII[1]

THE BIRDS OF MALAITA ISLAND (BRITISH SOLOMON ISLANDS)

By Ernst Mayr

When the Whitney South Sea Expedition undertook the exploration of the Solomon Islands, bird collections had been made by earlier explorers on all the larger islands except Malaita. The only place I find Malaita mentioned in ornithological publications is in some of Ramsay's papers. But the locality in these cases cannot be correct, as neither of Ramsay's two collectors (Cockerell and Morton) ever visited Malaita Island.

Malaita was formerly considered a dangerous place on account of its very independent and savage natives, and even the fearless Meek did not risk going there, in spite of being urged to do so by Lord Rothschild. In the last twenty years the situation has greatly improved, but even recently there have been several clashes between the natives and the whites which delayed the work of the Whitney Expedition for a considerable time. Due to these circumstances, Malaita was the last island of the Solomon Group to be visited. After all the hardships and the danger connected with this visit, the members of the expedition felt amply repaid by the success of the first ornithological exploration of this large island, a task of high interest and value to science.

The present paper consists of a preliminary report on the bird collection, including a list of the specimens taken and descriptions of the new forms. In a few cases a review of the geographic variation of a whole species has been given. In the final report on the birds from the Solomon Islands collected by the Whitney South Sea Expedition, more details will be given about the zoögeographic position of Malaita Island and its bird life.

Here it may be briefly stated that Malaita, although it has three endemic species (*Rhipidura malaitæ*, *Pachycephala sanfordi*, and *Zosterops stresemanni*) and several indigenous subspecies, on the whole shows a close affinity to Guadalcanar in its bird life. Concerning the geography of the island and the collecting stations of the expedition, I shall confine myself in the present paper to the following short notes.

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[1] Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356 ,364, 365, 370, 419, 469, 486, 488, 489, and 502.

Malaita Island lies somewhat apart from the northern chain of the Solomon group and stretches from north-northwest to south-southeast, its northern point (Cape Astrolabe) lying at 160° 40′ E. and 8° 20′ S., and the southern point (Cape Zelée) at 161° 40′ E. and 9° 45′ S. The island is about 120 miles long, but at its widest part only 20 miles wide. There are no large plains, most of the island being covered by low hills not rising above 2000 feet in the north or the south of the island. The mountainous area is confined to the center (see map) where we find quite an extensive massif of a general altitude of more than three thousand feet. The highest summit (Mt. Torombusu) reaches about 4300 feet. The island, being the most thickly populated of the whole Solomon Group, has lost a good deal of its original forest, which has been replaced by native gardens and secondary growth.

Bird collections were made at the following places (see map):

AUKI.—Near sea-level, Jan. 26–29, 1930; H. Hamlin, E. Mayr, W. F. Coultas, and W. J. Eyerdam.

SU'U.—Near sea-level, Feb. 1–Feb. 15, 1930; H. Hamlin, E. Mayr, W. F. Coultas, and W. J. Eyerdam. Feb. 26–March 3, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

ERIGOMANO.—2000 feet, March 4–10, 1930; same party.

MT. TOROMBUSU.—4000 feet, March 12–15, 1930; same party. March 16–19, 1930 (without Hamlin).

WANGAFUFU.—Near Arorla, 3000 feet, March 20–29, 1930; W. F. Coultas and W. J. Eyerdam.

ARORLA (or Aurola).—3000 feet, March 30–April 10, 1930; W. F. Coultas and W. J. Eyerdam. April 11–15, 1930 (with Hamlin).

KWARAMBARA (Olimburi district).—Sea-level, April 17, 1930.

The collection consists of 1060 specimens representing 62 species, 16 of which are indigenous forms. Endemic forms have been named *malaitæ* in many cases, in order to make the range conspicuous. I am much indebted again to Lord Rothschild for the loan of valuable specimens from the Tring collection and to Mr. Arthur Goodson for many notes and measurements. The arrangement of the families and genera is the same as in Amer. Mus. Novit., No. 486. All measurements are in millimeters, weights in grams, and colors according to Ridgway's 'Color Standards.'

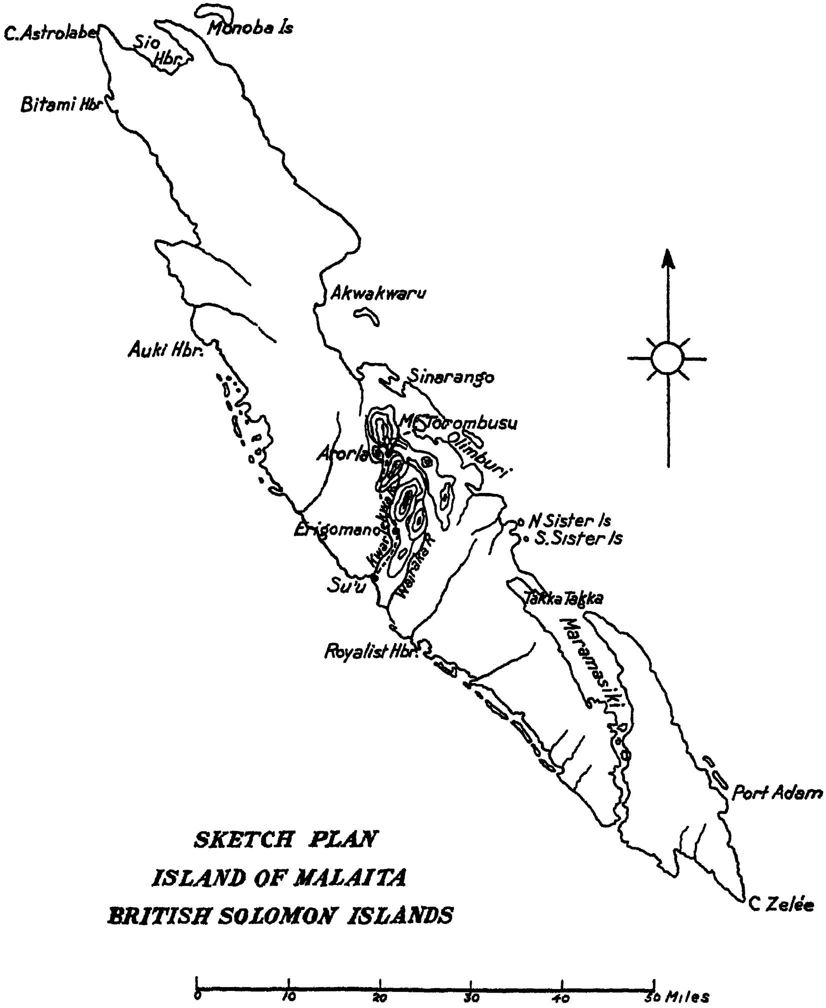

Fig. 1. Malaita Island, showing the mountainous region in the center, the route (dotted line), and the important collecting stations of the Expedition.

Outline of the island after the British Solomon Islands Public Survey; mountains, rivers, and villages in central part after the field notes and sketches of the Whitney South Sea Expedition (H. Hamlin).

1.[1] **Demigretta sacra** (Gmelin)

Ardea sacra GMELIN, 1789, 'Syst. Nat.,' I, part 2, p. 640, Tahiti, Society Islands.
1 ♂ (Feb. 10, 1930).

2. **Nycticorax caledonicus mandidularis** Ogilvie-Grant

Nycticorax mandibularis OGILVIE-GRANT, 1888, Proc. Zool. Soc. London, p. 203, Guadalcanar, Solomon Islands.
1 ♀ (April 8, 1930).

3. **Butorides striatus macrorhynchus** (Gould)

Ardetta macrorhyncha GOULD, 1848, 'Birds Australia,' VI, part 31, Pl. LXVI, New South Wales, Australia.
1 ♀ (Feb. 6, 1930).

4. **Anas superciliosa pelewensis** Hartlaub and Finsch

Anas superciliosa var. *pelewensis* HARTLAUB AND FINSCH, 1872, Proc. Zool. Soc. London, p. 108.
1 ♂ (March 4, 1930).

5. **Accipiter novæhollandiæ malaitæ**, new subspecies

TYPE.—No. 226706, Amer. Mus. Nat. Hist., ♀ ad.; Malaita Island, British Solomon Islands; April 15, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—The gray of the upperside much darker than in any of the other subspecies of *novæhollandiæ* in Melanesia; underside not uniform, but with narrow whitish bars.

FEMALE ADULT (type and unique specimen).—Cheeks, ear-coverts, sides of neck, hindneck, pileum, and forehead dark neutral gray (R.53); back, wing-coverts, edges of wings, dark fuscous-gray; tail-feathers dark gray, with indistinct black cross-bars; middle of throat dark gray with narrow whitish or rusty bands; breast dark rust-colored (Mikado-brown, R.29) with fuscous and buff bands; belly and flanks lighter (about pale orange-cinnamon, R.29) with white cross-bands, which broaden toward the thighs, crissum, and under tail-coverts; under wing-coverts and axillaries orange-cinnamon with white bars; quills with indistinct narrow black bars, inner webs of primaries with broad buff bands. "Iris chrome-yellow; lid cadmium-yellow; bill black, base of under mandible chrome-yellow; cere cadmium-yellow; feet cadmium-yellow." "Female with a pair of ovaries containing small white eggs."

MEASUREMENTS.—Wing, 238; tail, 196; culmen (without cere), 17.5; tarsus, 62; weight, 290 gr.

This very striking new subspecies is easily distinguished from all other representatives of *Accipiter novæhollandiæ* in the Solomon Islands by its dark upperside and barred under surface. There is also a tendency to have bars on the primaries; in the other Melanesian subspecies of *novæhollandiæ* the primaries show very light bars. From *leucosomus* (New Guinea) and *dampieri* (Bismarck Archipelago) *malaitæ* differs by its richer coloration on the underside and the darker head and upperside.

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[1] Species collected on Malaita Island are numbered consecutively.

6. **Accipiter albogularis** Gray

Accipiter albogularis Gray, 1870, Ann. Mag. Nat. Hist., (4) V, p. 327, San Cristobal Island, British Solomon Islands.

1 ♀ (Feb. 15, 1930).

This specimen belongs to the variety which is white underneath with no rufous band across the neck.

Haliæëtus species and *Haliastur indus girrenera* (Vieillot), both common species in the Solomon Islands, were observed, but not collected.

7. **Aviceda subcristata gurneyi** (Ramsay)

Baza Gurneyi Ramsay, 1881, Journ. Linn. Soc. London, XVI, p. 130, Ugi Island, British Solomon Islands.

1 ♀ juv. (Feb. 8, 1930).

8. **Pandion haliætus cristatus** (Vieillot)

Buteo cristatus Vieillot, 1816, 'Nouv. Dict. d'Hist. Nat.,' nouv. éd., IV, p. 481, Australia.

1 ♂ (Feb. 8, 1930).

9. **Megapodius freycinet brenchleyi** Gray

Megapodius brenchleyi, G. R. Gray, 1870, Ann. Mag. Nat. Hist., (4) V, p. 328, Gulf Island (=Ugi Island).

1 ♀ (March 2, 1930).

As I have no typical material of *eremita* Hartlaub from the Ninigo Islands, I cannot say by what characters *brenchleyi* can be distinguished from *eremita*.

10. **Porphyrio albus** subspecies

3 ♂ (February 9, March 7, and April 13, 1930).

The geographic variation of this species will be treated in a later paper.

A forest rail (either *Amaurornis olivacea* or *Eulabeornis woodfordi*) was observed, but no specimens could be obtained.

11. **Actitis hypoleucos** (Linnæus)

Tringa hypoleucos Linnæus, 1758, 'Syst. Nat.,' 10th Ed., p. 149, Sweden.

1 ♂ (Feb. 5, 1930).

12. **Pluvialis dominicus fulvus** (Gmelin)

Charadrius fulvus Gmelin, 1789, 'Syst. Nat.,' I, part 2, p. 687, Tahiti.

1 ♀ (Feb. 26, 1930).

13. **Ptilinopus superbus superbus** (Temminck)

Columba superba Temminck, 1810, 'Les Pigeons,' p. 75, Pl. xxxiii, Otaheiti, (error =) Halmaheira.

15♂, 12♀ (Jan. 28–April 11, 1930). From the lowland up to 3000 feet.

Ptilinopus solomonensis Gray

Several subspecies of this species (*meyeri* and *neumanni*) have been described by Hartert in recent years from the Bismarck Archipelago. A study of the geographical variation of this species in the Solomon Islands has been thus far impossible because of inadequate material. A splendid series of 128 males of this dove from thirteen different islands of the Solomon Group gives me the welcome opportunity to complete this task. Even this rich material is not sufficient to settle every point. My series from three islands (Pavuvu, Buena Vista, and Ramos) is too small to decide to which subspecies the specimens belong.

Ptilinopus solomonensis solomonensis G. R. Gray

Ptilonopus solomonensis G. R. Gray, 1870, Ann. Mag. Nat. Hist., (4) V, p. 328, Wanga, San Cristobal [description of juvenal].

Ptilopus ceraseipectus Tristram, 1879, Ibis, p. 442. Makira Harbour, San Cristobal.

Subspecific Characters.—Small size; lores and forepart of the crown covered with a single violet patch; red patch on belly pale and rather vinaceous, about tourmaline pink (R. 28); upperside rather dull green.

	Wing[1]	Weight
♂	116–125(120.6)	83–112(98)
♀	115–122(119.2)	83–107(95)

Range.—San Cristobal and Ugi Island, eastern Solomon Islands. Rare in the lowland, common in the hills and mountains.

Ptilinopus solomonensis ocularis, new subspecies

Type.—No. 218786, Amer. Mus. Nat. Hist.; ♂ ad.; Guadalcanar Island, British Solomon Islands; July 27, 1927; R. H. Beck and F. P. Drowne.

Subspecific Characters.—Large size; red on the crown restricted to two small anteocular patches; middle of crown green like hindneck; belly-patch less vinaceous, with a tendency toward purple.

	Wings
10♂	127–134(130.7)
2♀	126, 127

Range.—Guadalcanar Island, British Solomon Islands.

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[1] The tail of this species has not been measured, since it is impossible to get correct results on account of the heavy upper tail-coverts.

14. **Ptilinopus solomonensis ambiguus**, new subspecies

TYPE.—No. 226573, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; March 15, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Very similar to *solomonensis*, but less red on the head; the red patch on the forepart of the crown restricted to two loral spots in all of the adult males, but occupying a larger area than in *ocularis;* belly-patch usually paler; green on the upperside and on the flanks slightly richer and more olive; larger than *solomonensis*.

	WING	WEIGHT
9♂ ad.	120–127(124)	104–123(115.3)
9♀ ad.	118–126(120.4)	88–116(106.6)
3♂ I.Y.	117, 120, 123	96, 97, 100
4♀ I.Y.	112–117(115.8)	88–101(96.6)
6♂ juv.	110–115(112.3)	81–99(90.3)

FIRST-YEAR PLUMAGE

MALE.—So similar to the adult male that it is possible that this plumage may not be recognizable in every specimen; differs by being smaller; the red on the forepart of the crown is still connected; the primaries, especially the second, third, and fourth narrower and more pointed; the under wing-coverts, especially on the wing-bend, are distinctly margined with yellow; the yellow edges on secondaries and tail-feathers are broader, and the primary-coverts have narrow light edges.

FEMALE.—Very similar to adult female, but usually distinguishable by smaller size and more pointed wing-feathers.

It is doubtful if this plumage is really a first-year plumage. All the characters that distinguish it from the adult plumage show a tendency toward juvenal plumage, and, as there is no other known case of a pigeon having two plumages before reaching the adult dress, it is possible that the above-described plumage is only a "Hemmungskleid"[1] or "retarded plumage" of the adult. This possibility is strengthened by the fact that this plumage is recognizable only in exceptional cases in the other races of *Ptilinopus solomonensis*. A more exhaustive study of this phenomenon will be undertaken in one of my next papers.

JUVENAL PLUMAGE

MALE.—Green, darker above, lighter below, somewhat glossy on wings and tail; throat grayish-green; feathers of back, rump, upper tail-coverts, and breast with narrow yellow edges; feathers of abdomen, under and upper wing-coverts and secondaries with broad yellow edges; middle of lower abdomen and under tail-coverts yellowish; forehead with a few vine-colored feathers.

FEMALE.—Similar to juvenal male, but forehead gray-green; yellow edges on body feathers narrower or absent; yellow on lower abdomen and under tail-coverts paler, almost whitish; the young male has also sometimes a few reddish feathers and an indistinct yellow band on the upper belly which are always absent in the female.

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[1] For this term see Stresemann, 1920, 'Avifauna Macedonica,' p. xvi.

Ptilinopus solomonensis vulcanorum, new subspecies

TYPE.—No. 220412, Amer. Mus. Nat. Hist.; ♂ ad.; Kulambangra Island, British Solomon Islands; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Similar to *solomonensis*, red on the forehead not split into two supraloral patches; but belly more violet, about argyle purple (R.37) against tourmaline pink (R.38) in *solomonensis*; the green of the upperside more olivaceous; more and larger blackish spots on the scapulars.

WING MEASUREMENTS

	MALES	FEMALES
Kulambangra	123–129(125.2)	121–128(124)
Rendova		120, 122
Vangunu	120–126(123)	
Gatukai	118–123(120.2)	120
Ganonga	120, 122	
Vella Lavella	124	

RANGE.—Volcanoe Islands of central Solomon Islands.

There is some variation in size and the coloration of the belly-patch, but all specimens are distinguished by the large spots on the scapulars.

Ptilinopus solomonensis bistictus, new subspecies

TYPE.—No. 221078, Amer. Mus. Nat. Hist.; ♂ ad.; Bougainville Island, British Solomon Islands; January 27, 1928; F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Very similar to *ocularis* from Guadalcanar, but supraloral spots much larger, sometimes almost meeting on the pileum; general coloration paler, which applies to the yellow on the breastband and on the under tail-coverts, to the red on the belly-patch and supraloral spots, and to the green on upperside and flanks.

Wing: males, 126–133 (130.5); females, 124–131 (127.5).

RANGE.—Bougainville Island.

It is remarkable how similar the Bougainville subspecies is to the one inhabiting Guadalcanar. Both islands are 270 miles apart and separated by a long chain of islands which are inhabited by another subspecies of *solomonensis*.

Ptilinopus solomonensis subspecies

Besides the islands mentioned above, representatives of this species were also collected on Buena Vista Island (1 ♀ juv.), on Ramos Island (2 ♂ juv.), and on the Pavuvu Islands. This material is not sufficient to decide as to what subspecies these birds belong. The single adult male of Pavuvu Island (wing, 122 mm.) is remarkably similar to typical *solomonensis*.

Ptilinopus solomonensis neumanni Hartert

Ptilinopus solomonensis neumanni Hartert, 1926, Nov. Zool., XXXIII, p. 42, Nissan Island.

Subspecific Characters.—Large, red on forehead more purplish than in *solomonensis* and decidedly paler (not of the same color, as Hartert says), reaching farther up the pileum; red on belly slightly less vinaceous; green on upperside, on throat and flanks darker; wing of males, according to Hartert, 130–134.

Material collected by the Whitney Expedition (Aug., 1929) has the following measurements.

	Wing	Weight
5♂	127–131(128.6)	91–105(98.2)
4♀	124–133(128.0)	92–98(95)

To the west of the Solomon Islands, we find the following subspecies.

Ptilinopus solomonensis johannis Sclater

Ptilopus johannis Sclater, 1877, Proc. Zool. Soc. London, p. 556, Admiralty Islands.

Range.—Manus (Admiralty Islands), St. Matthias Island, Squally Island, New Hanover, and Nusa Island (north of New Ireland).

Ptilinopus solomonensis meyeri Hartert

Ptilinopus solomonensis meyeri Hartert, 1926, Nov. Zool., XXXIII, p. 173, Witu Islands.

Range.—New Britain, Uatom Island, Witu or French Islands, and Rook Island.

Ptilinopus solomonensis speciosus Schlegel

Ptilopus speciosus Schlegel, 1871, Nederl. Tijdschr. Dierk., N., p. 23, Méfoor et Soëk [Numfor and Biak], Islands of Geelvinkbay.

Subspecific Characters.—Supraloral spots very small; green of head and neck very brilliant, almost glossy; green of back, rump, and scapulars with a distinct olive tinge; bluish-black spots of scapulars absent; lower and lateral edge of yellow breastband white; small size.

Range.—Islands of Geelvinkbay (Numfor, Biak = Misori, and Traitor Islands)

This bird has always been somewhat of a puzzle to the systematist because, although resembling *Ptilinopus rivolii bellus*, it occurs on the same islands as *Ptilinopus rivolii prasinorrhous*. A remark in the great work of Salvadori,[1] who compared the bird with *P. s. johannis*, put me on the right track. An examination of specimens which I received from Tring Museum justified my suspicion that *Ptilinopus speciosus* is merely a subspecies of the widespread *Ptilinopus solomonensis*. Except for the yellow-and-white breastband it shows very little similarity to *Ptilinopus rivolii bellus*.

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[1] 1882, 'Ornitologia della Papuasia e delle Molucche,' III, p. 48.

15. **Ptilinopus viridis lewisi** Ramsay

Ptilopus Lewisi Ramsay, 1882 (March), Proc. Linn. Soc. N.S.W., VI, 1881, p. 724, Lango, Guadalcanar.

9 ♂, 4 ♀ (Feb. 5–15, March 2–10, and April 5, 1930).

Ducula pistrinaria pistrinaria Bonaparte is a common species along the coast, but no specimens were collected, as the expedition had already secured a sufficient series on other islands.

16. **Ducula brenchleyi** (Gray)

Carpophaga Brenchleyi G. R. Gray, 1870, Ann. Mag. Nat. Hist., (4) V, p. 328, Wanga, San Cristobal.

1 ♀ im. (Feb. 4, 1930).

17. **Ducula rubricera rufigula** (Salvadori)

Carpophaga rufigula Salvadori, 1878, Atti R. Acad. Sci. Torino, XIII, p. 536, San Cristobal Island.

8 ♂, 6 ♀ (Feb. 3–12, March 17–25, 1930).

18. **Columba vitiensis halmaheira** (Bonaparte)

Carpophaga halmaheira Bonaparte, 1855, 'Consp. Gen. Avium,' II, p. 44, Halmaheira Island, northern Moluccas.

2 ♂ (March 15, April 5, 1930).

There is a great deal of individual variation in this species, but many of the birds of eastern New Guinea (*"rawlinsoni"*) and the Solomon Islands seem to be more greenish, the birds of western New Guinea and the Moluccas more purplish. However, I cannot definitely settle this point because I have seen only very little material from the Moluccas. A few specimens from the Solomon Islands are almost as purplish as typical birds, so it does not seem to be advisable to separate the eastern birds.

The last revision of this species by Hartert, (1925, Nov. Zool., XXXII, p. 118) is rather misleading. *Columba pallidiceps* (+*philippanæ*) is a distinct species, which occurs side by side with *Columba vitiensis halmaheira* Bonaparte over a wide range. I have, at present, not enough material to decide whether or not *philippanæ* differs any from *pallidiceps*.

Genus *Gymnophaps* Salvadori

Gymnophaps Salvadori, 1874, Ann. Mus. Civ. Gen., VI, p. 86.

Type (by monotypy).—*Gymnophaps albertisii* Salvadori.

Generic Characters.—Strong, heavy, and well-curved bill; lower mandible consisting of two plates; nostrils covered with a long-stretched operculum; circumocular space and lores naked; tarsus feathered about half of its length or more. Toes with broad soles, even middle toes slightly webbed; tail long, not graduated.

This genus has been sunk by Stresemann and other authors, but I do not think it can be united with *Columba*, especially since the new species *solomonensis*, which is undoubtedly a representative of *albertisii*, shows many striking peculiarities that make it impossible to regard it as a member of the genus *Columba*.

19. **Gymnophaps solomonensis**, new species

Type.—No. 226670, Amer. Mus. Nat. Hist.; ♀ ad. (ovary with large yellow eggs); Malaita Island, March 13, 1930, Hamlin, Coultas, and Eyerdam.

Description.—Male and female adult: forehead, crown, and hindneck pale gull gray; throat and sides of neck lighter, almost whitish; middle of throat sometimes with a light-vinaceous tinge, color of breast and belly very varying, rarely of a pallid neutral gray (R.LIII), mostly a mixture of pallid gray and pale vinaceous, sometimes an almost pure pale vinaceous; thighs pale gray; under tail-coverts light gray; feathers on the middle of the back dark gull-gray with a slight greenish sheen, a subterminal black band and a deep gull-gray edge; scapulars and lesser wing-coverts dark gray with a black edge and a distinct greenish sheen; rump light gull-gray, darker toward the back; upper tail-coverts and tail-feathers pale neutral-gray, in worn condition tinged with brownish; wing-feathers and greater wing-coverts blackish with a green gloss.

Juvenal: similar to adult, but feathers softer; crown cinnamon-buffy; underside with hardly any vinaceous tinge; all feathers of underside and neck with minute blackish spots; tertials, innermost lesser wing-coverts, and under tail-coverts tinged with cinnamon; wings and wing-coverts duller.

Iris orange, eye-lid red, bill straw-yellow, feet pinkish (lead-gray).

Culmen, 22–23; exposed culmen, 17–19; tarsus, 28–32; tail about 150–170.

	Wing	Weight	Wing	Weight
Malaita				
	♂ ad. 222–236(230.2)	300–400(325)	♀ ad. 211–224(219.6)	275–325(315)
Bougainville				
	♂ ad. 223–236(230.4)		♀ ad. 213–225(218.6)	
Guadalcanar				
	♂ ad. 233		♀ ad. 216–224(218.2)	
Vangunu				
	♂ ad. 215, 216, 225, and 226		♀ ad.	

Two young birds from Bougainville Island (1♂, 1♀) have wings of 204 and 211 mm.

Range.—Mountainous islands of the Solomon group. Malaita Island: 15♂, 6♀ (March 13–April 14, 1930).

This species shows a great deal of individual variation. Breast and belly are usually more or less vinaceous, but sometimes of a pure gray. The color of the back (and scapulars) also varies considerably, sometimes a more glossy greenish-black prevails, sometimes a dull grayish-black. In size the specimens from Malaita, Bougainville, and Guadalcanar agree very well; four birds from Vangunu (Central Group), sexed as males, are smaller, but the sexing is perhaps not correct.

This species, one of the finest discoveries of the Whitney Expedition, is restricted to the high mountain forest (above 3000 feet). It seems to be fairly common wherever it occurs. It is not surprising that this mountain species was not previously discovered because, prior to the Whitney Expedition, the mountain forest of the Solomon Islands had never been explored.

The range of the genus *Gymnophaps* is of great geographical interest; it is almost identical with that of *Micropsitta bruijni*, a distribution which I do not regard as accidental: mountains of the Moluccas, New Guinea, Bismarck Archipelago, and Solomon Islands. However, I do not believe that these mountain areas have been connected in recent geological times, for, in this case, we would expect a much stronger component of Papuan elements in the mountains of the Moluccas and Solomon Islands.

20. **Coryphœnas crassirostris** (Gould)

Turacoena crassirostris Gould, 1856, Proc. Zool. Soc., p. 136, Guadalcanar, British Solomon Islands.

7 ♂, 2 ♀ (Feb. 9–11, March 7–28, April 11–14, 1930).

21. **Macropygia rufa arossi** Tristram

Macropygia arossi[1] Tristram, 1879 (Oct.), Ibis, p. 443, Makira Harbour, San Cristobal Island.

Macropygia rufocastanea Ramsay, 1879 (Dec.), Proc. Linn. Soc. N.S.W., IV, p. 314, Lango, Guadalcanar Island.

11 ♂, 11 ♀ (March 5–26, April 4–11, 1930).

22. **Chalcophaps stephani mortoni** Ramsay

Chalcophaps Mortoni Ramsay, 1882 (March), Proc. Linn. Soc. N.S.W., VI, p. 725, Ugi Island.

5 ♂, 4 ♀ (Jan. 31, Feb. 6–11, 1930).

23. **Eos cardinalis** Gray

Lorius cardinalis Gray, 1849, 'Gen. Birds,' App. 20, Ysabel Island, Solomon Islands.

4 ♂, 2 ♀ (Feb. 1–5, 1930).

24. **Lorius chlorocercus** Gould

Lorius chlorocercus Gould, 1856, Proc. Zool. Soc. London, p. 137, San Cristobal Island.

A good series of males and females (Feb. 1–15, Feb. 27, March 6–28, April 1–15, 1930).

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[1] Mr. Gregory M. Mathews kindly confirmed my opinion, that *arossi* is the earlier name for this subspecies.

25. **Trichoglossus ornatus aberrans** Reichenow

Trichoglossus aberrans Reichenow, 1918, Journ. f. Ornith., p. 439 [eastern part of Kaiser Wilhelmsland, error for:] Blanche Bay, New Britain.

2 ♂, 1 ♀ (Jan. 28–Feb. 5, 1930).

26. **Charmosyna margarethæ** Tristram

Charmosyna margarethæ Tristram, 1879, Ibis, p. 442, Makira Harbour, San Cristobal Island.

14 ♂, 7 ♀ (March 15–28, April 3–15, 1930).

27. **Charmosynopsis palmarum meeki** Rothschild and Hartert

Hypocharmosyna meeki Rothschild and Hartert, 1901, Nov. Zool., VIII, p. 187, Kulambangra Island, British Solomon Islands.

11 ♂, 5 ♀ (March 13–25, 1930).

I do not see any reason for keeping this form specifically separated from *palmarum*.

28. **Cacatua ducorpsii** Pucheran

Cacatua ducorpsii Pucheran, 1853, 'Voy. Pôle Sud,' Zool., III, p. 108 [Ysabel Island], Solomon Islands.

6 ♂, 3 ♀ (Jan. 28, Feb. 5, March 5–7, 25–28, April 2, 1930).

29. **Micropsitta finschii aolæ** (Ogilvie-Grant)

Nasiterna aolæ Ogilvie-Grant, 1888, Proc. Zool. Soc. London, p. 189, Aola, Guadalcanar Island, British Solomon Islands.

7 ♂, 1 ♀ (Feb. 3–15, 26, 1930).

Agrees perfectly with a series from Guadalcanar.

30. **Eclectus pectoralis salomonensis** Rothschild and Hartert

Eclectus pectoralis salomonensis Rothschild and Hartert, 1901, Nov. Zool., VIII, p. 82, Fauro Island, Solomon Islands.

4 ♂, 8 ♀ (Feb. 3–5, March 6–7, March 26–27, April 9–12, 1930).

31. **Geoffroyus heteroclitus heteroclitus** Hombron and Jacquinot

Psittacus Geoffroyus heteroclitus Hombron and Jacquinot, 1841, Ann. Sci. Nat., p. 319, San Jorge et Ysabel.

16 ♂, 13 ♀ (Jan. 28, Feb. 5–11, Feb. 27–28, March 6, 7, 18, 25, 27, April 3–9, 1930).

32. **Cuculus optatus** Gould

Cuculus optatus Gould, 1845, Proc. Zool. Soc. London, p. 18, Port Essington, northwestern Australia.

1 ♀ semiadult (April 15, 1930).

Mr. J. L. Peters kindly identified this bird for me.

33. **Cacomantis variolosus addendus** Rothschild and Hartert

Cacomantis addendus Rothschild and Hartert, 1901, Nov. Zool., VIII, p. 185, Kulambangra Island, British Solomon Islands.

6 ♂ (Feb. 8, 10, March 9, 15, April 1, 4, 1930).

34. **Eudynamis scolopacea alberti** Rothschild and Hartert

Eudynamis orientalis alberti Rothschild and Hartert, 1907, Nov. Zool., XIV, p. 440, Gizo Island, British Solomon Islands.

2 ♀ (Feb. 8 and 11, 1930).

35. **Urodynamis taitensis** (Sparrman)

Cuculus taitensis Sparrman, 1787, 'Museum Carlson.,' fasc. II, No. 32, Tahiti Island.

1 ♀ (April 15, 1930).

Collected at an altitude of 3000 feet. Ovary small.
Migrant from New Zealand.

36. **Ninox jacquinoti malaitæ**, new subspecies

Type.—No. 226710, Amer. Mus. Nat. Hist., ♂ ad.; Malaita Island, British Solomon Islands; April 6, 1930; H. Hamlin, W. J. Coultas, and W. J. Eyerdam.

Subspecific Characters.—Similar to *Ninox jacquinoti roseoaxillaris*, but much darker and larger, under- and upperside slightly barred.

Description.—Type specimen (male adult): Upperside dark rufous-brown (natal brown, R.XL); edges of feathers lighter rufous, especially on head, neck, and rump; all feathers with more or less distinct pairs (one on each web) of rufous-buffy spots, which are most conspicuous on hindneck and scapulars; wing-coverts similar, but less rufous; forehead, superciliary stripe, and triangular spot on throat white; preocular bristles blackish brown, some with white bases; ear-coverts dark rufous-brown; breast and sides of the breast rufous-brown (mars brown, R.XV), belly and flanks much lighter and more rusty; feathers of the middle of the breast with whitish, on the sides with pale rufous spots or cross-bars; abdomen and flanks with numerous, but indistinct, narrow whitish cross-bars; thighs buffy, under tail-coverts buffy with rufous tips. Wing-and tail-feathers dull brown; tail-feathers with a few narrow white bars; three outer primaries with buffy-whitish spots on the outer web, inner primaries with one or two spots on the lower end; on the inner web with broad white bars which are pinkish near the base; axillaries pinkish, under wing-coverts partly rufous-brown, partly pinkish.

The other specimen collected (female juvenal) is very similar, but the cross-bars on under- and upperside are more pronounced, even visible on the ear-coverts; forehead and superciliary dirty white. "Iris dark gray, bill pale greenish-yellowish white, feet dirty yellow brown."

	Wing	Tail	Tarsus	Culmen (from cere)	Weight
♂	165	93	32	16	
♀	164	(84)	30	15	174

Only two specimens were obtained.

Range.—Malaita Island.

All the *Ninox* from the Solomon Islands must be treated as one species; they represent each other and are characterized by the more or less pinkish axillaries and the white throat.

37. **Tyto alba delicatula** (Gould)

Strix delicatulus GOULD, 1837, Proc. Zool. Soc. London, 1836, p. 140, New South Wales.

1 ♀ ad. (April 12, 1930).

Two species of *Collocalia* were observed, but no specimens secured.

38. **Hemiprocne mystacea woodfordiana** (Hartert)

Macropteryx mystacea woodfordiana HARTERT, 1896, Nov. Zool., III, p. 19, Guadalcanar Island, British Solomon Islands.

3 ♂, 4 ♀ (Feb. 4–8, March 18–19, April 8–12, 1930).

Alcedo atthis salomonensis ROTHSCHILD AND HARTERT, was observed on several rivers, but no specimens could be obtained.

39. **Ceyx lepidus nigromaxilla** (?) Rothschild and Hartert

Ceyx lepida nigromaxilla ROTHSCHILD AND HARTERT, 1905, Nov. Zool., XII, p. 256, Guadalcanar Island.

Only one specimen (♀, April 1, 1930, 3000 ft.) was collected on Malaita Island.

	WING	TAIL	CULMEN	TARSUS	WEIGHT
1 ♀	61	25	38	9	23

"Iris brown, bill, upper mandible black, lower mandible deep yellow, feet deep yellow."

This unique specimen is closest of all the Solomon Island forms to *nigromaxilla*, of which also I unfortunately have only one specimen for comparison. The Malaita bird differs from the Guadalcanar bird in the following characters: underside much lighter, on breast and flanks not of a deep ochraceous-orange (almost xanthine-orange, R.III), but yellow ochre; upperside also decidedly lighter; blue[1] spots on head and neck not violet-ultramarine (R.X), but about phenyl-blue (R.IX); the same differences exist for the tips of the wing-coverts, the edges of the inner secondaries and the scapulars; back, rump, and upper tail-coverts between methyl-blue and light methyl-blue; lower mandible deep yellow, not red.

More material must be inspected before this apparently new form can be named.

40. **Halcyon chloris alberti** Rothschild and Hartert

Halcyon tristrami alberti ROTHSCHILD AND HARTERT, 1905, Nov. Zool., XII, p. 256, Kulambangra Island, British Solomon Islands.

5 ♂, 7 ♀ (Feb. 4–10, March 27, April 1–14, 1930).

The Malaita specimens are decidedly lighter underneath than

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[1] Blue colors as seen with the light.

alberti. But as typical *tristrami* are also lighter than *alberti*, I must first see a series of New Britain specimens, before I can name the Malaita bird.

Halcyon saurophaga Gould is common along the coast, but was not collected because many specimens had been taken previously on other islands of the Solomon Group.

41. **Eurystomus orientalis solomonensis** Sharpe

Eurystomus solomonensis SHARPE, 1890, Proc. Zool. Soc. London, p. 552, Solomon Islands.

5♂, 5♀ (Feb. 3–9, March 19–29, 1930).

42. **Rhyticeros plicatus mendanæ** Hartert

Rhyticeros plicatus mendanæ HARTERT, 1924, Bull. Brit. Orn. Club, XLV, p. 46, Guadalcanar Island, British Solomon Islands.

4♂, 1♀ (March 7, 18, April 1–8, 1930).

Hirundo tahitica subfusca was frequently recorded, mainly along the coast.

43. **Coracina papuensis eyerdami**, new subspecies

TYPE.—No. 227189, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; H. Hamlin, E. Mayr, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Similar to *elegans*, but above darker gray, breast-band also darker gray; larger; bill longer and heavier.

	Wing	Bill[2]	Width of Bill[3]	Weight
eyerdami[1] (Malaita)				
13♂ ad.	140–146(142.2)	18–20	13	66–86(75)
3♂ juv.	135, 137, 140			64, 68, 69
13♀ ad.	136–144(139.6)			69–82(74.6)
1♀ juv.	136			70
Collected Jan. 27–31, Feb. 1–10, 26, March 6, 1931.				
elegans (Guadalcanar, Malapar, Beagle Island)				
15♂ ad.	135–141(138.5)	17–18	12	
1♂ juv.	134			
11♀ ad.	130–137(132.8)			
1♀ juv.	129			

RANGE.—Malaita Island, British Solomon Islands.

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[1] The length of the tail (approximately 107–111) cannot be used as comparative measurement in this species, for the heavy upper tail-coverts prevent correct measuring.

[2] From anterior edge of nostril to the tip.

[3] On the base of the lower mandible.

I name this new subspecies in honor of Mr. W. J. Eyerdam, our associate on the Whitney Expedition, since he always showed much interest in this species.

44. **Coracina lineata malaitæ**, new subspecies

Type.—No. 227165, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; April 4, 1930, H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

Subspecific Characters.—Similar to *solomonensis*, but males: slightly lighter and less bluish; secondaries and wing-coverts with narrow white edges; lower abdomen and under tail-coverts with signs of transversal bars; axillaries and under wing-coverts barred black and white; in *solomonensis* they are bluish-gray like the rest of the body with narrow white bars. Females: much lighter than *solomonensis* females, white edges on wings and wing-coverts much broader; white bars on abdomen, under tail-coverts, under wing-coverts, and axillaries much broader.

	Wings	Weight
12 ♂ ad.	131–139(134.4)	58–71(63.7)
1 ♂ juv.?	134	
5 ♀ ad.	129–131(130)	65–70(67.4)
4 ♀ juv.	126–128(127)	61–71(63.8)

13 ♂, 9 ♀ (Feb. 3, 15, March 5, 10, 22–31, April 1–12, 1930).

Range.—Malaita Island, British Solomon Islands.

Edolisoma holopolium

Only a few specimens of this rather rare species were collected before the activities of the Whitney Expedition. Thus far no subspecies have been separated.

Edolisoma holopolium holopolium (Sharpe)

Graucalus holopolius Sharpe, 1888, Proc. Zool. Soc. London, p. 184, Guadalcanar Island.

Buka and Bougainville: wings, ♂ 117, 119, 121; ♀ 115, 116, 116, 117.
Choiseul: wings, ♂ 109, 113, 114, 115, 116; ♀ 110, 111.
Ysabel: wings, ♂ 114, 117; ♀ 111, 114, 116.
Guadalcanar: wings, ♂ 112, 113, 114, 116, 117, 120; ♀ 106, 111, 111.

Range.—Guadalcanar, Ysabel, Choiseul, Bougainville, and Buka.

There is a great deal of individual variation in this subspecies, mainly concerning the shape of the nuchal collar, the size of the black patch on the forehead, and the width of the gray edges on the wing. But all these variations seem to have no geographical meaning. Bougainville birds are generally larger, Choiseul birds smaller, Ysabel and Guadalcanar specimens intermediate. The measurements overlap to such an extent that it is impossible to separate the populations of the different islands into subspecies.

Edolisoma holopolium pygmæum, new subspecies

TYPE.—No. 221686, Amer. Mus. Nat. Hist.; ♂ ad.; Kulambangra Island, British Solomon Islands; October 1, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—Similar to *holopolium*, but much smaller, gray on upperside, wing-coverts and edges of wing-feathers darker; black on forehead and nuchal collar restricted.

		WING	TARSUS
Kulambangra	2 ♂ ad.	99, 104	20, 20
	1 ♂ juv.	99	20
Vangunu	1 ♂ ad.	100	20.5

This is the smallest *Edolisoma*, I know of.

45. **Edolisoma holopolium tricolor**, new subspecies

TYPE.—No. 227258, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; March 28, 1930; W. F. Coultas, W. J. Eyerdam, and H. Hamlin.

SUBSPECIFIC CHARACTERS.—Very different from *holopolium;* forehead broadly black; both sides of the neck always connected with a broad black nuchal collar; primaries and primary-coverts entirely black without gray edges; wing-coverts and edges of secondaries, very light, almost whitish gray; smaller.

♂ ad.: wing 106–113 (109.1); weight 40–49(45.1)
♀ ad.: wing 100–106 (103.4); weight 40–49(43.1)

Birds collected at 3000 feet are slightly larger than those collected below 1500 feet (average in males 109.8 against 107.9).

The whitish upper wing-coverts contrasting with the black of the underside and the gray of the upperparts make this bird unusually handsome for an *Edolisoma.*

RANGE.—Malaita Island, British Solomon Islands (Feb. 10–15, 26, March 6–31, April 4–15, 1931).

46. **Edolisoma tenuirostre erythropygium** Sharpe

Edoliisoma erythropygium SHARPE, 1888, Proc. Zool. Soc. London, p. 184, Guadalcanar Island.

15 ♂, 18 ♀ (Feb. 6–12, 26–27, March 5–9, 26–31, April 4–15. 1930).

The Malaita birds do not agree perfectly with typical *erythropygium;* although the males seem to be identical in coloration, the females are a shade paler below, have less rust color on the rump and larger blackish-brown areas along the shaft of the tail-feathers, furthermore they are slightly larger than Guadalcanar birds and have stronger bills.

For *saturatius*, Rothschild and Hartert give the following wing measurements: males, 116–126; females, 114–118.

For the Malaita and Guadalcanar birds I find the following wing measurements:

	GUADALCANAR	MALAITA
♂ ad.	(7)[1] 114–122(118.3)	(11)[1] 120–128(122.7)
♂ juv.	(2) 114, 115(114.5)	(4) 116–120(117.7)
♀ ad.	(9) 113–118(115.7)	(12) 113–123(119.1)
♀ juv.	(6) 109–115(112.3)	(6) 112–119(116.8)

Weights of Malaita birds: ♂ ad., 64–80 (73); ♂ juv., 71–83 (74.6); ♀ ad., 65–82 (73.4); ♀ juv., 62–72 (68.5).

47. **Mino dumontii sanfordi** Hartert

Mino dumontii sanfordii HARTERT, 1929, Amer. Mus. Novit., No. 364, p. 18, Guadalcanar Island.

A series of males and females (Jan. 27–28, Feb. 3–8, March 25–31, April 4–15, 1930).

Birds from Malaita Island agree in size with typical *sanfordi.*

48. **Aplonis metallica nitida** (Gray)

Calornis nitida GRAY, 1858, Proc. Zool. Soc. London, p. 181, New Ireland, 1 ♂, 2 ♀ (Jan. 27–28, 1930).

Aplonis grandis (Salvadori)

This large starling has been found on all the islands of the Solomon Group, but none of the several subspecies has been named thus far, except *dichroa* Tristram, a very distinct race inhabiting San Cristobal Island.

Rothschild and Hartert[2] have already called attention to the fact that measurements of specimens from the different islands do not agree. However, lack of available material prevented them from undertaking a revision of this species. The fine series obtained by the Whitney Expedition gives me the welcome opportunity to undertake this task.

Size is always the most useful character in distinguishing black birds. But, in this case even size does not help much because the average of wing length of this species of starling is different on every island. Before treating the subspecies recognized by me, I am giving measurements of all the material I examined. Birds collected between November and March are usually in very worn plumage or molting and often could not be used for measurements.

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[1] Number of measured specimens.

[2] 1902, Nov. Zool., IX, p. 584.

	Wing	Tail	W.-T.[1]—Index	Weight
Buka				
1 ♂ ad.	150	98	65.3	
2 ♂ juv.	138, 140	88, 88		
1 ♀ ad.	140	88	62.9	
Bougainville (northern and northeastern part, mostly mountainous country)				
10 ♂ ad.	142–151(146.8)	92–99(96)	63.1–66.9(65.2)	
3 ♂ juv.	137, 139, 139	82, 89, 89		
8 ♀ ad.	139–146(142.2)	88–94(91.9)	62.0–66.7(64.6)	
6 ♀ juv.	135–139(136.7)	83–88(85.4)		
Bougainville (lowlands of south: Buin)				
7 ♂ ad.	146–152(148.3)	93–98(96.2)	63.3–67.1(65.1)	151–203(170)
5 ♀ ad.	140–147(142.6)	88–93(90.6)	61.8–65.5(63.6)	132–162(151.2)
1 ♀ juv.	139	84		153
Choiseul				
14 ♂ ad.	144–157(151.3)	95–102(98.1)	62.5–66.2(64.7)	149–178(162.2)
3 ♂ juv.	140, 143	87, 88, 91		
6 ♀ ad.	141–150(145.9)	91–100(95.3)	64.1–66.0(65.1)	
Ysabel				
12 ♂ ad.	152–162(157.3)	98–106(102.2)	63–66(65.0)	
6 ♀ ad.	148–152(150.0)	95–101(97.7)	63.8–66.5(64.6)	

Central Solomon Islands

	Wing	Tail	W.-T.[1]—Index	Weight
Vella Lavella				
3 ♂ ad.	153, 156, 157	98, 99, 101	62.4, 64.7, 64.7	
3 ♀ ad.	142, 147, 148	88, 92, 94	62.0, 62.6, 63.5	
1 ♀ juv.	135			
Ganonga				
2 ♂ ad.	155, 157	97, 99	61.8, 63.9	
1 ♂ juv.	147	91		
1 ♀ ad.	147	91	61.9	
Kulambangra				
2 ♂ ad.	153, 155	98, 99	63.9, 64.1	
3 ♀ ad.	143, 146, 147	86, 91, 92	60.1, 62.3, 62.6	
New Georgia				
4 ♂ ad.	147–158(152.8)	96–101(98.5)	63.6–66.7(64.5)	
2 ♀ ad.	146, 149	93	62.4	
Vangunu				
3 ♂ ad.	148, 150, 155	92, 95, 102	62.2, 63.4, 65.8	
Gatukai				
2 ♂ ad.	147	91, 91	61.9	
1 ♀ ad.	141	86	61.0	
Rendova				
2 ♂ ad.	156, 159	99, 99	62.3, 63.5	
1 ♂ juv.	143	91		

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[1] $\text{Index} = \frac{\text{Tail} \times 100}{\text{Wing}}$

	Wing	Tail	W.–T.[1]—Index	Weight
Florida				
1♂ ad.	161[2]	103	64.0	
1♂ juv.	144	94		
Guadalcanar (*macrura*)				
12♂ ad.	142–149(144.8)	97–103(101)	68.0–71.8(69.8)	
6♂ juv.	134–141(137.8)	88–99(95.2)		
13♀ ad.	135–144(140.0)	91–102(96)	67.4–71.8(69.1)	
1♀ juv.	131	90		
Malaita (*malaitæ*)				
14♂ ad.	133–146(141.1)	89–94(91.5)	62.2–66.9(64.5)	126–154(142)
6♂ juv.	131–137(134.9)	82–88(86.2)		128–153(137)
15♀ ad.	135–144(138.8)	85–91(87.8)	61.1–65.7(63.5)	128–144(135)

Aplonis grandis grandis (Salvadori)

Lamprocorax grandis Salvadori, 1881, 'Ornit. Pap. e Mol.,' II, p. 460, new name for

Lamprotornis fulvipennis Pucheran, 1853, 'Voy. Pôle Sud.,' Zool., III, p. 81, Ysabel Island (*nec* Swainson, 1837, 'Anim. Men.,' p. 298).

Calornis maxima Tristram, 1895, Ibis, p. 375, Ysabel Island.

This subspecies agrees in coloration all over the northern, western, and central Solomon Islands, but there is a considerable difference in size. The largest population is found on Ysabel Island and on Florida Island. Birds from the Central Group are slightly smaller and have sometimes considerably smaller tails (Gatukai!). Still smaller is the series from Choiseul Island, and the smallest members of this race occur on Bougainville Island. The measurements of the Bougainville and Ysabel birds do not overlap, but as the birds of so many other islands are intermediate in size, it seems to be wiser not to give any name to the Bougainville population. To state the fact that the birds of this island are smaller, is quite sufficient. Naming the Bougainville birds would raise the difficult question as to what name to apply to the birds from Choiseul and all the islands of the Central Group.

Aplonis grandis macrura, new subspecies

Type.—No. 218560, Amer. Mus. Nat. Hist.; ♂ ad.; Guadalcanar Island, British Solomon Islands; July 23, 1927; R. H. Beck and F. P. Drowne.

Subspecific Characters.—Similar to *grandis*, but smaller and with relatively much larger tail (see index–table, pp. 20–21), feathers of throat and neck broader and shorter, less lanceolate.

Range.—Guadalcanar Island (British Solomon Islands).

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[1] $\text{Index} = \frac{\text{Tail} \times 100}{\text{Wing}}$

[2] Rothschild and Hartert (*loc. cit.*) give 152–160 for three Florida specimens.

49. **Aplonis grandis malaitæ**, new subspecies

Type.—No. 227576, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; Feb. 26, 1930; Hamlin, Coultas, and Eyerdam.

Subspecific Characters.—Still smaller than *macrura* and with decidedly shorter tail; differs from both *grandis* and *macrura* in having lower throat, upper breast, sides of breast, and neck greenish instead of dark purplish; green on back, upper wing-coverts and rump sometimes more bluish; lanceolate feathers of throat and neck still shorter.

Range.—Malaita Island, British Solomon Islands (Jan. 28, Feb. 5–12, 26, March 27–29, April 3–8, 1930).

This subspecies approaches the peculiar *dichroa* of San Cristobal Island somewhat in size and coloration.

50. **Pachycephala sanfordi**, new species

Type.—No. 227316, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; March 21, 1930; H. Hamlin, W. F. Coultas, and W. G. Eyerdam.

Description.—Male adult: head, hindneck, chin, sides of head, and ear-coverts black; entire underside golden (chrome) yellow; feathers on throat sometimes with blackish tips; back, rump, scapulars, wing-coverts, edges of secondaries, and inner primaries dark yellowish-olive; lower edges of outer primaries fuscous; axillaries white with grayish centers and yellow edges; under wing-coverts yellow and white; upper tail-coverts black with brownish-olive tips; tail-feathers black, outer edges blackish olive near the base. Female adult: crown olive-citrine, more or less mixed with dark rufous-brown; lores lighter; circumocular feathers buffy; ear-coverts isabella to light brownish-olive; cheeks white or yellowish white with dark bands across the feathers; throat and upper breast whitish with darker shaft stripes and grayish bars which give these parts a somewhat mottled appearance; middle of breast and abdomen white with a pale-lemon wash, breast feathers with grayish centers; sides of breast light grayish-olive; flanks fulvous olive; under tail-coverts yellow; axillaries and larger under wing-coverts white with light gray centers; lesser under wing-coverts yellowish; upper wing-coverts, tertials, and outer webs of secondaries and primaries rust-brown, sometimes with narrow olive margins; upper tail-coverts and tail-feathers more or less brownish olive.

"Iris gray brown, bill black, feet grayish"; bill (from nostril), 13–14; culmen, 22–24; tarsus, 26–27.

	Wing	Tail	Weight
♂ ad.	100–107(103.3)	73–78(75.5)	47–55(51.3)
3♂ juv.	100, 103, 103	73, 75, 76	51, 51, 52
♀ ad.	98–103(100.1)	71–75(73.2)[1]	46–53(49.5)
4♀ juv.	94–97(94.7)	68, 73, 73	44–49(46.8)

Series of males and females (Feb. 12–15, 26, March 5–25, 1930).

This interesting species is apparently a representative of *Pachycephala pectoralis*, but it is reasonable to treat it as a separate species because of the absence of the black pectoral band and the color characters of the female. In habit and behavior, the bird does not differ from its relatives in the Solomon Island Group (*orioloides, christophori*, etc.).

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[1] Once 79.

51. **Monarcha castaneiventris castaneiventris** Verreaux

Monarcha castaneiventris Verreaux, 1858, Rev. et Mag. de Zool., (2) X, p. 304, "l'Ile Samoa, l'une des Navigateurs," error, type locality fixed as Guadalcanar (cf. Hartert, 1908, Nov. Zool., XV, p. 363).

Series of males and females (Feb. 5–12, 27, March 5–28, April 2–4, 1930).

52. **Monarcha barbata malaitæ**, new subspecies

Type.—No. 227067, Amer. Mus. Nat. Hist.; ♂ ad. Malaita Island, British Solomon Islands; February 26, 1930; H. Hamlin, W. F. Coultas, and W. G. Eyerdam.

Subspecific Characters.—Similar to *barbata* Ramsay, but three outer tail-feathers entirely white, central pair bluish black, fourth and fifth pair white with more or less bluish black on tip; bluish-black patch on throat and upper breast wider, almost touching the black of the hindneck and thus nearly isolating the white patch of the sides of the neck; slightly larger.

	Wing	Tail	Weight
♂ ad.	83–89(85.4)	75–81(77.9)	21–26.5(22.8)
♂ juv.	76–78(77.2)	70–74(72)	19–23.5(20 6)
♀ ad.	78–85(81.9)	72–77(73 5)	20–24(21.9)
♀ juv.	77–81	74	20–24.5

Range.—Malaita Island (Feb. 3–15, 26–27, March 6–31, April 3–11, 1930).

Male and female are alike in coloration, but the feathers on the crown and throat are usually softer and less lanceolate in the females. The juvenal plumage of this species is very puzzling. I shall treat it later, in connection with the juvenal plumage of the other subspecies of this species.

There is considerable individual variation; the wing-coverts are in some specimens entirely white, in others more or less mixed with black, especially on the inner web; the base of the central pair of tail-feathers is in some specimens extensively white. One female (No. 227106) is albinistic and shows some white feathers on the head, in the area which is altogether white in *verticalis;* the gap between *barbata* and *verticalis* is thus lessened by individual variation.

Monarcha barbata belongs together with *Monarcha verticalis, menckei*, and *infelix* to the superspecies *Monarcha trivirgatus*. It is significant for the "system" in Mathews' 'Syst. Av. Austr.,' that the different species and subspecies of this superspecies are scattered over three genera: *Monarchalba, Piezormona*, and *Symposiachrus*, all of which are synonyms of *Monarcha*.

53. **Myiagra ferrocyanea malaitæ,** new subspecies

TYPE.—No. 227020, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands, February 3, 1930; H. Hamlin, E. Mayr, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Male adult: similar to that of *ferrocyanea,* but back, rump, upper tail-coverts, wings, and tail less glossy, sheen on back more purple.

Female adult: similar to that of *feminina,* by having no rust color on back or tail, but differing by the longer bill and the conspicuous rusty edges of the secondaries.

	WING	TAIL	WEIGHT
♂ ad.	70–74(72.5)	59–65(62)	13–16(14)
♂ juv.	68–70(68 6)	58, 58, 60	12.5–13.5(13.1)
♀ ad.	68–72(69.2)	57–62(59.4)	12.5–14(13.3)
♀ juv.	66, 66, 67	59, 60	12, 12, 12

One adult male (No. 227059) is unusually small (wing, 69; tail, 58; weight, 12.5).

The male in first-year plumage is very much like the adult female, but crown and back more glossy.

This plumage is preceded by a downy nestling plumage (as shown by No. 227033), which is white underneath and dusky grayish above.

RANGE.—Malaita Island (Jan. 31, Feb. 1–12, 27, March 5, 10, 15, 16, 18, 20, 1930).

54. **Rhipidura[1] leucophrys melaleuca** (Quoy and Gaimard)

Muscipeta melaleuca QUOY AND GAIMARD, 1830, 'Voyage de l'Astrolabe,' Zool. I, p. 180, New Ireland.

2 ♀ (Feb. 5, March 6, 1930).

55. **Rhipidura cockerelli coultasi** Mayr

Rhipidura cockerelli coultasi MAYR, 1931, Amer. Mus. Novit., No. 502, p. 5, Malaita Island.

17 ♂, 18 ♀ (Feb. 1–12, March 6–31, April 3–15, 1930).

56. **Rhipidura rufifrons brunnea** Mayr

Rhipidura rufifrons brunnea MAYR, 1931, Amer. Mus. Novit., No. 502, p. 19, Malaita Island.

16 ♂, 8 ♀ (March 4, 21–31, April 1–15, 1930).

57. **Rhipidura malaitæ** Mayr

Rhipidura malaitæ MAYR, 1931, Amer. Mus. Novit., No. 502, p. 20, Malaita Island.

21 ♂, 16 ♀ (March 13–28, April 3–15, 1930).

58. **Phylloscopus trivirgatus becki** Hartert

Phylloscopus trivirgatus becki HARTERT, 1929, Amer. Mus. Novit., No. 364, p. 13. Guadalcanar Island, British Solomon Islands.

4 ♂, 6 ♀ (March 15–17, April 11, 1930)

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[1] For further notes on this genus see Amer. Mus. Novit., No. 502.

The crown of the birds is slightly darker than in typical *becki*, otherwise they are identical. Bougainville, Kulambangra, and San Cristobal have endemic, not yet described subspecies.

59. **Cinnyris jugularis flavigaster** (Gould)

Nectarinia flavigastra Gould, 1843, Proc. Zool. Soc. London, p. 104, New Ireland.
5 ♂, 6 ♀ (Jan. 27–28, Feb. 4–8, 26, March 10, 1930).

60. **Myzomela cardinalis malaitæ**, new subspecies

Type.—No. 227476, Amer. Mus. Nat. Hist.; Malaita Island, British Solomon Islands; Feb. 9, 1930; E. Mayr, H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

Description.—Male adult: head, sides of head, sides of throat and breast, neck, back, wings, and tail dull black; narrow edges on wing-coverts, quills, and along the bases of the tail-feathers dull olive; middle of throat, breast, flanks, rump and upper tail-coverts scarlet-red; middle of abdomen and under tail-coverts dark gray with an olive tinge; axillaries and under wing-coverts gray.

Male in first-year plumage: forehead and forepart of crown dark brown with broad red feather-tips; chin, cheeks, upper and middle of lower throat red, hindneck hair-brown, sides of neck, scapulars, and back brownish-drab; rump dull rufous-cinnamon; underside (except throat) tawny olive (R.XXIX), middle of abdomen lighter, breast and flanks darker; wing-coverts, wings, and tail hair-brown, wing-coverts with ochraceous, wing- and tail-feathers with olive edges, inner edge of wing-feathers white.

Female: upperside dirty brownish-gray (hair-brown), head darker, on forehead with a slight reddish tinge; rump and upper tail-coverts lighter and more rufous; upper tail-coverts sometimes with an olive or reddish tinge; throat dull blackish-brown, with narrow red tips on feathers of upper throat; underside, wing, and tail as in young male.

Iris brown, bill black, feet bluish gray.

Culmen, males 19–21, females 18–20; bill (from nostril), males 13–14, females 12–12.5; tarsus 17–18.

	Wing	Tail	Weight
♂ ad.	66–70(67.6)	44–49(47)	13–17(14.6)
♂ juv.	59–66(64.2)	38–44(41.9)	13–15(13.8)
♀	57–61(59)	38–41(39.6)	10.5–12.5(11.5)

Besides *Rhipidura malaitæ* and *Pachycephala sanfordi* this bird is the most interesting discovery made on Malaita. The black on head and back makes this form very different from the other subspecies of *cardinalis*, so different that I hesitated a long time before considering it a subspecies of *cardinalis*. On the other hand, this new subspecies closely approaches *Myzomela jacquinoti* in its coloration. This is the more significant as they represent each other geographically also. But the differences in coloration are important enough to keep *jacquinoti* specifically separated from *cardinalis*.

61. **Dicæum æneum æneum** Pucheran

Dicæum æneum PUCHERAN, 1853, 'Voy. Pôle Sud.,' Zool., III, p. 97, St. George (near Ysabel), Solomon Islands.

A fine series of males and females (Jan. 28–31, Feb. 1–11, 26, March 4–31, 1930).

62. **Zosterops stresemanni,** new species

TYPE.—No. 227362, Amer. Mus. Nat. Hist.; ♂ ad.; Malaita Island, British Solomon Islands; Feb. 6, 1930; Hamlin, Mayr, Coultas, and Eyerdam.

DESCRIPTION.—No traces of a white eye-ring, circumference of eye naked; back dull warbler-green (between warbler-green (R.IV) and serpentine-green (R.XVI), pileum more olive and with fuscous edges to the feathers, rump and upper tail-coverts more yellowish; sides of head and ear-coverts yellowish green; underside citron-yellow on the flanks and throat mixed with grayish green; breast, especially sides of breast, greenish; under tail-coverts citron-yellow with a rufous-olive tinge; under wing-coverts and axillaries (yellowish) white; wing- and tail-feathers fuscous-black, externally edged with bright olive, tertials dull olive; inner edge of wing-feathers white.

The juvenal plumage is almost identical with the adult, but the feathers, especially on the underside, are softer, the wing-feathers rounder, and the tail-feathers narrower with a broader olive edge.

"Iris light brown; bill grayish on upper mandible, pale yellow with a grayish tip on the lower mandible; feet greenish gray."

Culmen, 17–19; bill (from nostril), 10–11.5; tarsus, 20–21.

	WING	TAIL	WEIGHT
♂ ad.	67–73(69.2)	43–47	20–24(22.7)
♂ juv.	64–69(67.4)	42–43	21–25(22)
♀ ad.	65–69(67.7)	42–45	20.5–24(22.2)
♀ juv.	64–66(64.8)	41–43	19–22.5(20.7)

RANGE.—Malaita Island (Jan. 27–31, Feb. 1–15, Feb. 26–27, March 4–26, 1930).

I name this new species in honor of my friend Prof. Dr. Erwin Stresemann, who, in his recent revision of the Indo-Australian species of *Zosterops*,[1] was the first to succeed in giving a natural classification of this difficult genus. His paper was of great value to me in the task of finding the systematic position of this new species.

Zosterops stresemanni, one of the largest species of the genus, has apparently no close relatives. In the soft texture of its plumage, in general coloration, and the absence of a white eye-ring, it agrees rather well with *sanctæ-crucis*. But in the latter species the plumage is still softer, the vicinity of the eye is feathered (not naked), bill and tail are relatively shorter, and the entire distal part of the lower mandible dark. Considering also the wide geographic separation, it is even doubtful if both species can be called representatives. Nevertheless, there is no other species to which *stresemanni* shows as many similarities as it does to *sanctæ-crucis*.

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[1] 1931, Mitt. Zool. Mus. Berlin, XVII, pp. 201–238.

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56 9,33A (1181:51.7)

A NEW INSECTIVORE FROM THE OLIGOCENE, ULAN GOCHU HORIZON, OF MONGOLIA[1]

BY GEORGE GAYLORD SIMPSON

Among the most noteworthy of the numerous new fossil mammals found by the American Museum Asiatic Expeditions in 1928 is an insectivore skull and skeleton assigned to me for study by Walter Granger, Palæontologist of the expedition, and described below.

The specimen is of unusual importance, not only because of its relatively fine preservation, but also because it represents a new family allied to the pro-lemuroid Tupaiidæ (being the first fossil of which this can surely be said) and thus casts light on the affinities of certain groups of Insectivora and also on the origin of the Primates, one of the most discussed of evolutionary problems.

The delicate material has been most skilfully prepared by Albert Thomson. The drawings of the skull and jaws are by John Germann; those of the skeletal parts by Louise W. Germann.

ANAGALIDÆ, new family

TYPE.—**ANAGALE**, new genus.

KNOWN DISTRIBUTION.—Basal Oligocene of Mongolia.

DIAGNOSIS.—Dentition complete (with possible exception of I^1). Incisors unspecialized, canines small. Molarization of upper premolars advanced, but only one main outer cusp on P^4. M^{1-2} subquadrate, paracone and metacone external, not crescentic. Projecting hypoconulid on M_3. Skull tupaioid in general structure. Orbit open, but with postorbital processes. Alisphenoid canal present, supraorbital and malar foramina absent. Large entotympanic bullæ with very large circular auditory openings. Radius and ulna and tibia and fibula separate. Strong tibial malleolus. Astragalus trochlea shallow, little oblique, with foramen, fibular crest higher. Astragalo-cuboid facets. Cuboid short, metatarsals not elongated. Unguals of pes flattened dorsoventrally and spatulate at tips.

It may be found that not all of these characters are common to possible other genera of the now monotypic family, but they are similar to the features used to distinguish other families of insectivores and clearly show that *Anagale* cannot be placed in any of the latter without extensive redefinition.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 111.

Anagale[1] **gobiensis,** new genus and species

TYPE.—Amer. Mus. No. 26079. Nearly perfect skull and jaws with much of skeleton. Collected by the Chinese assistant "Buckshot," Central Asiatic Expedition, 1928.

HORIZON AND LOCALITY.—Lower Oligocene. Lower part of Ulan Gochu Formation, at Twin Oboes, in face of mesa east of Shara Murun Valley, Inner Mongolia.[2]

GENERIC AND SPECIFIC CHARACTERS.—Sole known genus and species of the family as defined above. Dental formula $?\frac{3}{3}\cdot\frac{1}{1}\cdot\frac{4}{4}\cdot\frac{3}{3}$. Incisors subequal, canines single-rooted but nearly premolariform. $P\frac{1}{1}$ two-rooted, simple. P^2 three-rooted, with small inner cusp. P_3 without metaconid. Length P^1-M^3, 22.5 mm. P_1-M_3, 24.2 mm. Total length of skull, ca. 58 mm. Zygomatic breadth 35 mm.

DESCRIPTION

DENTITION

The tips of the premaxillaries are incomplete (the only imperfection of the skull) so that the presence of anterior incisors cannot be determined. There were at least two, and probably three, upper incisors, the complete formula being $?\frac{3}{3}.\frac{1}{1}.\frac{4}{4}.\frac{3}{3}$.

If present, I^1 was probably small and well separated from its mate of the opposite side. I^2 is small, styliform, single-rooted, the crown not expanded. It is almost erect, procumbent only in the slightest degree. I^3 is known only from alveoli, which show it to have been slightly larger than I^2 and probably of the same character. The upper canine is but little higher than I^2 and of about the height of P^2. It is stouter than the incisors. The posterior slope is very faintly heel-like but not cuspidate. The root is single, but with a slight median vertical groove.

The upper premolars, four in number and without diastemata, are chiefly remarkable for the extent of their molarization, which extends to P^2, and for its nature, which does not lead to duplication of the main outer cusp. P^1 is small, two-rooted, with very indistinct anterior and posterior basal cuspules. The crown is somewhat wider posteriorly. P^{2-4} are three-rooted. They are much worn, but the essential structure is clear. Each has a main outer cusp, preceded and followed by slight basal cuspules. There is an internal cuspule, progressively more prominent and slightly more anterior. P^4 is subquadrate, with evidence of a fourth cusp, an incipient hypocone or a prominent metaconule, although its apex is worn off.

The molars are also much worn, but the bases of the cusps reveal most of the structure except the possible development of conules. They are quadrate, transverse, with three main cusps. The paracone and metacone are subequal, external, noncrescentic. The external cingulum is represented only by a vague and slight basal swelling. There is no mesostyle, while parastyle and metastyle appear to have been present but very small. The protocone was large and was followed by a much smaller dependent hypocone or pseudhypocone. M^3 was similar but smaller, the external border strongly oblique, the contour triangular, the posterointernal cusp small or absent.

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[1] Ανα, above Γαλεη, literally "weasel" but very commonly used in zoological nomenclature as a combining form for insectivores (e g., *Galerix*, *Microgale*, and many others). The name refers to the high position of this genus within the Insectivora and is also symphonious with its living allies among tupaiids *Anathana*, *Dendrogale*, and *Urogale*.

[2] For geographic and geologic occurrence, see Berkey, Granger, and Morris, 1929, and Osborn, 1929. The Ulan Gochu unconformably underlies the Baron Sog (Upper or Middle Oligocone) and is apparently conformable on the Shara Murun (Upper Eocene). *Anagale* is from an apparently basal Oligocene level. One specimen of *Embolotherium* was found in the same stratum at a slightly higher level and in the immediate neighborhood.

The lower incisors, three in number, are one-rooted, rather closely spaced, and styliform. I_3 is represented by the alveolus only. The lower incisors are more definitely procumbent than the upper. The lower canine is small, one-rooted, the crown resembling that of the incisors but higher and with a heel similar to that of the premolar but smaller.

The first three lower premolars increase progressively in size but are otherwise similar. Each has two roots, a high compressed main cusp, a low one-cusped heel, and a smaller but higher anterointernal cusp. There is no metaconid. P_4 is more definitely molariform. The lofty trigonid has subequal, opposite protoconid and metaconid and a low anteromedian paraconid. The heel is about equal in length to the trigonid or slightly less and is a little narrower. It is crested transversely at the posterior rim, but the cusp structure is obscured by wear.

M_{1-2} are of equal size and structure. The talonid is slightly larger than the trigonid. The latter is much compressed anteroposteriorly and was higher than the talonid. In the worn condition, the internal side is higher than the external, but this may differ from the original state. The character and position of the paraconid cannot be determined. M_3 has a similar but smaller trigonid. The talonid is elongate by reason of the posterior and slightly external projection of the hypoconulid, which is attached to the internal half of the talonid (as in the primitive lemuroid or tarsioid M_3).

SKULL

In its general proportions and superficial appearance, the skull resembles that of *Erinaceus*, although numerous differences in structural details are apparent. The more striking superficial distinctions are the large and partially enclosed orbits, the broader interorbital region, more sloping superior contour of the face, large bullæ, and higher occiput.

The nasals, which are not fused, are long and slender, slightly expanded anteriorly where each is notched, and still more expanded posteriorly. The premaxillæ are small and abbreviated. Each sends a slender process upward and backward between the maxilla and nasal, but this stops far short of contact with the frontals. The palatine processes of the premaxillæ began anterior to the second incisors, but are broken off on the specimen. The facial exposure of the maxilla is very large and it has a stout but relatively short zygomatic process. The infraorbital foramen is single, of moderate size, and lies above the anterior root of P_3.

The lachrymal has a small but distinct crescentic facial expansion. The lachrymal tubercle is unusually prominent and there are two subequal foramina, one above and one below the tubercle. These are placed in notches near the rim, but rather more on its facial side.[1]

The frontals are broad and nearly flat. They likewise are unfused in this old individual. The sutural pattern differs from that of *Ptilocercus* or *Erinaceus* in the shorter posterior extension between the parietals and the shorter paired anterior processes between the nasals and maxillæ. Near the nasal suture but wholly within the frontals is a pair of vascular foramina, directed forward, each about 1.5 mm. from the median suture. Since these must open into the nasal chamber, they cannot be homologous with the supraorbital foramina of *Tupaia*, and the latter are absent.

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[1] There are two foramina in the lachrymal of *Tupaia*, one below the tubercle and on the facial side of the rim, the other above and on the orbital side.

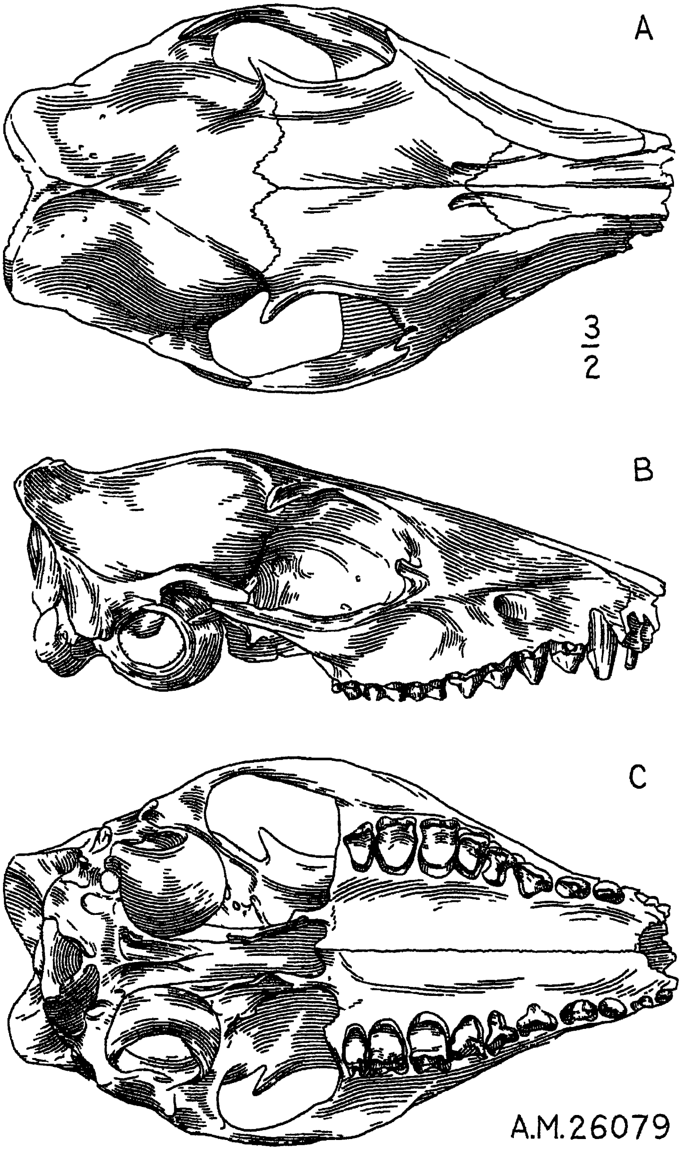

Fig. 1. *Anagale gobiensis.*
A, superior; B, Lateral; C, Palatal views of skull.
One and one-half times natural size.

The postero-external angle of each frontal is produced into a prominent, slender postorbital process, very like those of *Tupaia* save that they are slightly shorter and apparently did not meet processes from the jugal.

The parietals are fused and are much smaller over the cerebrum, the latter apparently being short but relatively large and well developed (better than in a living *Erinaceus* of comparable size). Faint crests arise from the bases of the postorbital processes and converge at a point immediately anterior to the occipital crest without becoming more prominent or forming a distinct sagittal crest. The occipital crest is very strong and much elevated, nearly as much as in *Gymnura* (which has, however, a strong sagittal crest as well). In the lateral concavities between this crest and the cerebral swellings, the parietals are pierced by irregular vascular foramina, five or six on each. No separate interparietal can be surely distinguished.

The squamous portion of the squamosal is small and extends forward much as in *Ptilocercus*. The glenoid fossa is triangular and nearly plane. The postglenoid process is a small nubbin between the glenoid and the auditory meatus. The zygomatic process of the squamosal is slender and extends forward to a point anterior to the postorbital process.

The jugal is slender but well developed and forms an essential part of the arch, maxilla and squamosal not being in contact. It appears to have no facial expansion but to send a slender process forward to the lachrymal along the upper side of the zygomatic process of the maxilla. It does not appear to have had a malar foramen or a postorbital process, the orbit being open behind. The posterior extension of the jugal is rod-like and reaches the glenoid fossa, as in marsupials (and *Tupaia*).

The occiput is high and quadrate, chiefly by reason of the great lambdoid crest. The bones are completely fused. Above the external ends of the condyles are pits, but apparently no foramina. The mastoid exposures are triangular and are lateral (as in tupaiids) rather than occipital (as in erinaceids).

The foramen magnum is subquadrate, transverse, with no superior notch but a well defined inferior notch. The articular surfaces of the condyles are nearly or quite continuous, anterior to this notch.

The basicranium is chiefly occupied by the large bullæ, which are noteworthy not only for their size but for their regularity of form, being almost perfect sections of spheres, and for their quite circular and remarkably large external auditory openings. The diameter of these openings is about 5.5 mm., that of the whole bulla (externally) about 10 mm.

Unlike the false bullæ of the lipotyphlous insectivores, these are sharply distinct from the basisphenoid. Within the left bulla (the shell of which was incomplete) was found a segment of a slender curved bone which I believe can only be the tympanic ring. If this is the case, the bulla is purely entotympanic, the true tympanic being annular and within the bulla—exactly the same condition as in *Tupaia* and its allies but in no other insectivores. Unlike *Ptilocercus*, the large bulla has cut off the petrosal from any exposure on the base of the skull. There is a distinct mastoid process in contact with the posterosuperior rim of the auditory opening, and a smaller, separate paroccipital process posterointernal to this.

The pterygoids and palatines form sharp continuous crests running nearly to the bullæ but not continuous with them. In the external angle between each of these and the bulla is a small sloping triangular alisphenoid shelf, at the anterior end of which the alisphenoid is produced into a sharp external pterygoid process, directed outward and slightly downward. This arrangement is very like that of the tupaiids, save that in the present form the internal pterygoid plates seem to have continued at the palatal level (somewhat crushed in the specimen), as they very nearly, but not quite, do in some tupaiids.

The choanæ are considerably narrower than the palate. There is a small median posterior projection of the palatines. The palate is broad and was thinly ossified. It is somewhat crushed, but there appear to be definite paired vacuities. The maxillo-palatine suture cannot be determined.

The orbitotemporal region, which so sharply distinguishes the menotyphlous and lipotyphlous insectivores, is unfortunately cracked somewhat so that sutures can hardly be determined positively. On the less crushed right side, however, there is an indubitable foramen opposite M^3 and at the angle between the median wall and floor of the orbit. The bone above and in front of this is visibly continuous without suture to the lachrymal. There seems little reason to doubt that this is the nasopalatine foramen and that the palatine is in contact with the lachrymal, excluding the maxilla from the frontal within the orbit, a diagnostic character of the Tupaiidæ and Macroscelididæ.

Cranial foramina

Infraorbital canal: small, about 85 mm. in length, infraorbital foramen over P_3.

Optic foramen: large, in orbitosphenoid, immediately above and anterior to the anterior lacerate foramen.

Anterior lacerate foramen: about equal to the foramen ovale in size.

Foramen rotundum: debouches with the anterior lacerate foramen, although they may be partially or completely separate more internally.

Alisphenoid canal: enters a small opening on the basal aspect to the alisphenoid, anterointernal to the foramen ovale, tunnels the base of the lateral pterygoid process, and passes out through a small opening in the external wall of the pit surrounding the anterior lacerate foramen and foramen rotundum.

Nasopalatine foramen: in the orbital plate of the palatine, opposite M^3.

Foramen ovale: subcircular, of moderate size, in the basal aspect of the alisphenoid, underhung by the anterior part of the bulla.

Post-glenoid foramen: large, internal to the post-glenoid process.

Stylomastoid foramen: wedged between the mastoid process and the bulla.

Eustachian foramen: at the anterointernal edge of the bulla immediately internal to the foramen ovale.

Posterior lacerate foramen: a slight gap around the posterointernal part of the bulla terminating postero-externally in a fairly large and almost circular foramen.

Carotid foramen: a small opening in the uppermost part of the exposed bulla at its posterior end immediately anterior to the large part of the posterior lacerate foramen.

Condylar foramen: very small and close to the articular surface of the condyle, between it and the posterior lacerate foramen.

Lachrymal foramen: there are two foramina in the lachrymal bone, both nearly marginal but rather on the facial side, one above and one below the lachrymal tubercle.

Various vascular foramina: a pair near the midline in the anterior part of the frontals, several in the parietals anterior to the lambdoid crest, and possibly others not positively identified.

The following foramina were doubtless present but cannot be distinguished on the specimen: anterior palatal foramen, posterior palatal foramen, ethmoidal foramen, sinus canal. Malar and supraorbital foramina are absent.

The other openings of the skull, nares, choanæ, auditory meatus, palatal vacuities, and foramen magnum have been described above.

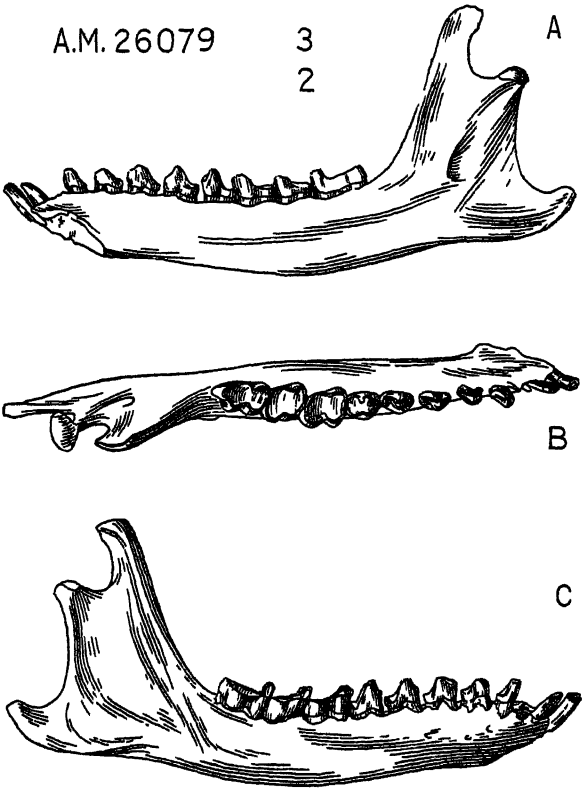

Fig. 2. *Anagale gobiensis.*

A, Internal; B, Superior; C, External views of right ramus of the lower jaw. One and one-half times natural size.

MANDIBLE

The right ramus of the lower jaw is perfectly preserved, the left less so. The moderately slender horizontal ramus has about the proportions seen in *Gymnura*. The largest mental foramen is beneath the anterior root of P_1. Two smaller ones are posterior to this, one between P_1 and P_2, and one beneath the anterior root of P_3. The angular process is pointed and hook-like, but is somewhat deeper than in *Tupaia* and projects directly backward rather than backward and downward. The articular condyle is elevated far above the dental level, and its transverse articular surface is slightly convex anteroposteriorly, as in many insectivores. The posterior border falls straight downward from it, not downward and forward. The coronoid process is very slender and high, slightly recurved. The relief of the inner side is slight save for a horizontal ridge and underlying concavity on the angle. The dental foramen is a small vertical slit at the molar level, with a very faint, short, oblique mylohyoid groove beginning at its lower end.

VERTEBRÆ

The entire cervical series is preserved. The atlas has a fairly prominent median dorsal tubercle, but no distinct ventral tubercle. The transverse processes are short but rather heavy, the ventral excavation not being deep. The structure is rather generalized, but closer to that of *Ptilocercus*, for instance, than of *Gymnura*. The arrangement of the canals is of the usual primitive type, seen also in both tupaiids and erinaceids. The axis has a prominent peg-like odontoid process. The relief of the inferior surface is not pronounced, but there is a sharp single median crest and lateral concavities. The transverse processes project to about the same line as the posterior end of the centrum and are pierced by the vertebrarterial canals which issue in the distinct notches between these processes and the atlanteal facets. The neural spine is expanded into an anteroposterior plate, but its outline is damaged.

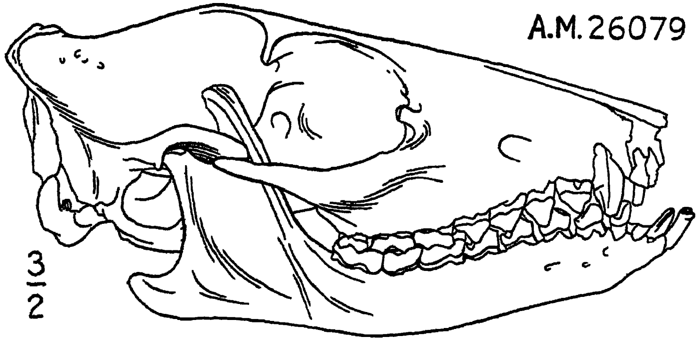

Fig. 3. *Anagale gobiensis.*
Outline of skull and jaw with teeth in occlusion.
One and one-half times natural size.

The succeeding cervicals are of the basic type typically developed (although with numerous variations in details) in the erinaceids, tupaiids, and related groups. The centra are somewhat flattened dorsoventrally and bear a slight ventral keel on the third and fourth vertebræ. The transverse processes of the third are simple and not unlike those of the axis. On the succeeding two vertebræ the transverse processes are expanded distally, and from their bases arise slender processes which project forward beneath the transverse processes of the next preceding vertebræ (cf. *Tupaia*, *Gymnura*, etc.). The sixth vertebra differs sharply from the others by the sharp division of the transverse process into dorsal and ventral lamellæ (transverse process proper or diapophysis and costal process or pleurapophysis). The dorsal part is like that of preceding vertebræ, while the ventral is directed outward and downward, compressed transversely, and broadly expanded anteroposteriorly. The nature of these processes on the seventh vertebra cannot be determined.

All of the cervicals (except the atlas) have distinct neural spines. These decrease in height from the axis to the sixth, while that of the seventh is abruptly higher, over twice that of the sixth, in transition to the very elevated anterior dorsal spines.

Parts of about fifteen dorsolumbars are present, but the preservation is rather poor. Of the anterior dorsals (preserved in series with the cervicals) nothing can be said beyond the fact that they had lofty slender neural spines, directed backward and reaching their greatest height at about the fourth or fifth. These spines constitute a marked adaptive difference from the tupaiids, but resemble *Rhynchocyon*, for instance.

Parts of six lumbars are preserved. Of these, three, in sequence, give most of the characters of the mid-lumbar region. The neural spines are broad anteroposteriorly, bluntly truncated, of moderate height, and directed forward. The zygapophyses are elevated and strong, with the articulation sharply concavo-convex transversely. The transverse processes are broad and long blades directed sharply outward and downward and somewhat forward. Small anapophyses are present, with the nerve exits through deep grooves or notches below them. No part of the sacrum has been identified. Isolated caudals are of quite usual type and indicate a long and heavy tail.

Anterior Extremity

The scapula has the approximate contour of *Gymnura* or *Tupaia:* the posterior border nearly straight, anterior and superior borders continuous and strongly curved, sharp posterosuperior angle, lofty spine, prespinous fossa larger than postspinous. It is less like that of *Ptilocercus*, *Erinaceus*, or *Rhynchocyon*. The posterior margin is strongly everted. The acromion is large and bifid, much as in *Gymnura*. The glenoid cavity has the same pyriform shape as in all of the genera mentioned. The coracoid process is broken off on both scapulæ of the specimen.

Imperfect proximal and distal ends of both humeri are preserved, but the shafts are missing. The head is ovoid and widely overhangs the posterior face of the shaft. The tuberosities are normal. The distal end is somewhat expanded. Its chief peculiarities are the large entepicondylar foramen, strong supinator crest, large globular capitulum, and narrow trochlea.

The proximal end of the ulna is stout, the olecranon expanded vertically and bent somewhat inward. The semilunar notch presents no unusual feature. Beneath and anterior to the coronoid process is a small, deep pit. The proximal part of the shaft is triangular, with large internoinferior and externosuperior faces and a narrow internosuperior face, all separated by prominent angulations. A prominent interosseous crest is present at about the middle of the externosuperior face. The distal end of this bone and the whole of the radius are unknown. The carpus is also lacking.

The manus is represented by an articulated fragment with the distal ends of two metacarpals, two complete digits, median and distal phalanges of a third, and distal phalanx of a fourth. These are probably parts of the first four digits of a right manus, although this is not wholly certain. Three of the digits (the second to fourth in any event) are of about equal size, but decrease slightly in length from one side to the other (from fourth to second on this interpretation). The articulations are of the expected type: metacarpal articulations half keeled, median articulations nearly cylindrical but slightly grooved, distal articulations a little more grooved. The proximal and median phalanges are stout and not elongate. The distal phalanges are considerably longer than the others and form large, curved, laterally compressed claw cores with proximopalmar tuberosities. They are strongly fissured. In addition to this material there are isolated proximal ends of the third and fourth metacarpals of the left side. The articular surface of the fourth is nearly quadrate, wider on the external side. It projects beyond the third and has a small facet for the unciform. The articular surface of the fourth metacarpal is unusually narrow transversely.

POSTERIOR EXTREMITY

A few fragments of the pelvis reveal none of its important characters. The femur is also poorly represented, only the heads of both and imperfect distal end of one being present. The head is spherical, with a strong foveal pit, and is borne on a constricted neck. On the distal end the condyles are of about equal development. A small patella is preserved.

The left tibia is well preserved except for the malleolus, and proximal and distal ends of the left fibula are present. The two bones are completely separate. The tibia is of primitive structure and agrees with that of *Tupaia* except in its stouter proportions and the better-developed cnemial crest, which is more prominent and extends about half way down the shaft. From its broken base and from its articular facet on the astragalus, it is clear that the malleolus was large and prominent, as in the Menotyphla.

The proximal end of the fibula shows a rather large, irregular, triangular expansion, the upper side of which articulates movably with the tibia. The shaft was rather slender but complete. The distal end has a blunt expansion, with an oval facet for the astragalus on its median face and a supero-median triangular facet for the tibia. The open peroneal groove passes posterior to an irregular but distinctive lateral projection.

Of the tarsus, there is an astragalus (lacking the head) and a cuboid, both of the left side.

The astragalus is of insectivore type and closely resembles that of *Tupaia* except for the presence of an astragalar foramen and for minor details of the inferior facets. The trochlea is broad and fairly shallow. The margins are sharp, subequal, but the fibular margin more prominent (tupaioid as opposed to erinaceoid). The malleolar facets are of equal size and are nearly parallel but converge slightly anterosuperiorly. A small astragalar foramen is present in the trochlea near the superior end of the fibular crest. The ectal and sustentacular facets are of equal size (the ectal is larger in *Tupaia*) and the latter apparently was not quite continuous with the fibular or navicular facets (unlike *Tupaia*) but it approaches both much more closely than in *Erinaceus* or *Gymnura*. The neck projects anterointernally and has the direction and relative development seen in *Tupaia*. The external side of the head has a small articulation for the cuboid. The navicular articulation is not preserved.

The chief point of interest about the cuboid is that it is shorter proximodistally than in any of the related modern insectivores examined. In both erinaceids and tupaiids (and even in the Paleocene *Prodiacodon*) it is moderately elongate, and in the Macroscelididæ it is extremely long, whereas in the present form it is unusually short. The superior surface has a small internal facet for the astragalus (absent in *Ptilocercus* but present in *Tupaia*), concave anteroposteriorly, and a large facet for the calcaneum, convex anterposteriorly and gently concave transversely. The latter facet is more oblique than in related forms, sloping distally in the dorsal and external directions. The plantar surface is marked by a large and sharply defined tuberosity which is transverse. The median surface has a crescentic proximal facet for the navicular, contiguous to that for the astragalus, and, distal to this, two small, separate, elevated facets for the third cuneiform. The surface for the fourth and fifth metatarsals is undivided and gently concave.

The length of the first metatarsal is unknown, but that of the others decreases in the following sequence: III, II, IV, V, the approximate lengths being 27, ca. 25, 23.5, and 20 mm., respectively. They are moderately stout bones and not especially elongate. The first metatarsal (represented only by the distal end from the left pes) is of about the same stoutness as the fifth. It is not known whether it was divergent. The proximal articulations of the third and fourth metatarsals are about as in *Gymnura* or *Tupaia* except that that of the third is less wedge-shaped, not contracting so much toward the plantar side. The fifth differs from *Gymnura* and agrees with *Tupaia* in not extending farther than the fourth proximally. It differs from *Tupaia* chiefly in the shorter but stouter external process which does not extend proximally. The distal articulations are of the usual transversely cylindrical type with plantar keels. The phalanges likewise have the usual type of articulation as in related forms, and in general have no interesting peculiarities except for the unguals. These differ from those of the front feet and from those of related living forms in being somewhat wider than deep proximally and distinctly flattened and depressed distally, almost spatulate, rather closely approximating the distal phalanges of some primitive lemuroids.

AFFINITIES

Previous discoveries in Mongolia include nothing closely comparable with *Anagale*. Four genera from the Cretaceous are confidently referred to the Insectivora and placed in two distinctive families, Deltatheridiidæ and Zalambdalestidæ (Simpson, 1928, and papers there cited). These share certain primitive characters with *Anagale*, such as the nearly complete dental formula, uninterrupted zygomata, etc. Especially in the case of the Zalambdalestidæ, they also have a few more advanced or divergent characters seen in the present genus, such as some degree of molarization of the premolars, narrow snout, contour of the mandible, and some other features, but these are ancestral characters of the Order Insectivora rather than indications of any special affinity. As would be expected, the Cretaceous families are more primitive on the whole, and some of their features would surely figure in the structural ancestry of *Anagale*, but they have no special generic or family resemblance to the latter, and some of their specializations (in the teeth if nowhere else) already exclude them from the ancestry of the Oligocene genus.

Two Paleocene genera, *Praolestes* and *Pseudictops* (Matthew, Granger, and Simpson, 1929), have been provisionally referred to the

Insectivora. They are known only from the teeth, which do not especially resemble those of *Anagale* in either case, and their reference to the Insectivora is very doubtful and made only in default of other indications.

Among Mongolian insectivores, the closest to *Anagale*, both in point of time and in structure, are *Tupaiodon* and *Palæoscaptor*[1] from the Hsanda Gol, an Oligocene formation more recent than the Ulan Gochu. Matthew and Granger provisionally referred *Tupaiodon* to the Tupaiidæ and *Palæoscaptor* to the Soricidæ. Study of new material (including an upper jaw of *Palæoscaptor*) suggests, first, that these two genera are closely related and should not be referred to separate families, and, second, that they are less closely related to the Tupaiidæ or Soricidæ than to the Erinaceidæ. *Tupaiodon* differs in numerous dental characters from any known tupaiid but shows a rather close general agreement with primitive gymnurines, such as *Galerix*. None of its known characters excludes it from the Gymnurinæ. *Palæoscaptor* is essentially similar, particularly in the upper teeth, but is somewhat more specialized in the reduction of M_2, larger and more secant M_1, and enlargement of one pair of incisors. To a limited degree these characters are convergent toward the soricoids, but they are wholly consistent with

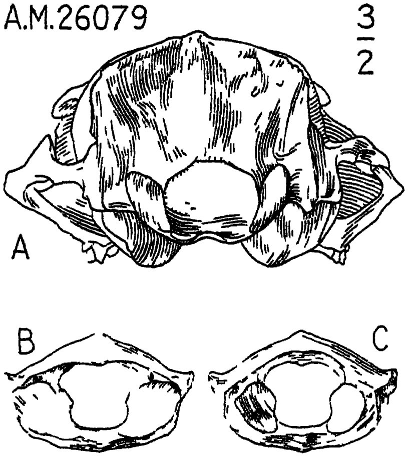

Fig. 4. *Anagale gobiensis.*

A. Posterior view of skull B, Anterior view of atlas vertebra. C, Posterior view of atlas vertebra

One and one-half times natural size

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[1] 1924 Matthew and Granger. There is also some important undescribed material which has been examined for its bearing on the present discussion

erinaceoid relationships, being less extreme than in some members of the latter group, and the differences from true soricoids, as recognized by Matthew and Granger, are numerous and important. The tibia and fibula of *Palæoscaptor* are known, and they are totally unlike those of the Tupaiidæ (or of *Anagale*) but agree in every essential with the Erinaceidæ.

The question of relationships between *Tupaiodon* and *Palæoscaptor* on the one hand and *Anagale* on the other is largely resolved by this view as to the relationships of the former genera. It suffices to say that they are not closer to *Anagale* than are other presumed erinaceids, as discussed below.

More specific discussion of the wider relationships of *Anagale* may be prefaced by some further analysis of the dentition. The following are its most striking primitive dental characters:

> Dental formula complete (with possible but improbable exception of I^1).
> Incisors subequal, one-rooted, styliform.
> Premolars all with divided roots.
> Pattern relatively little changed from tuberculosectorial.

Although primitive, these characters are to some degree diagnostic when taken in conjunction with the geologic age. Unless there were strong contrary evidence in other parts (which is not the case), they would at once exclude the Centetoidea and the Soricoidea, since both groups had lost various of these primitive characters by the Oligocene or long before. The only primitive characters never seen in recent tupaiids are the retention of $P\frac{1}{1}$ (and probably of three upper incisors) and of the two-rooted P_2. The two-rooted P_1 does not appear in any known erinaceid, but the other primitive characters are present in various Gymnurinæ.

Small, more or less premolariform canines appear in various genera and species of all tupaioid and erinaceoid families but are not especially typical of any one.

P_2 and, more notably, P^2 are more advanced than in any other genus of insectivores known to me.[1] There does not appear to be any other tupaioid or erinaceoid with three roots on P^2. P^3 is of the general type usual in gymnurines. It is more complex than in *Ptilocercus* or *Tupaia*, but not more than in other tupaiines such as *Anathana* and of about the same pattern. P^4 about equally resembles the less complex of the gymnurine homologues and those usual in the tupaiids. P_{3-4} likewise show equal resemblance to tupaiids and erinaceids.

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[1] P^2 is unknown in the probably insectivore family Plagiomenidæ, but from their extremely molariform P^{3-4} I suspect that it may have been as advanced as *Anagale* in this particular; but the dentition is otherwise so different as not to enter into this question.

The upper molar structure is not wholly clear, but the following facts are ascertainable. The general contour is most nearly approached in those tupaiids with relatively large hypocones (cf. *Anathana*), being more transverse and apparently with relatively smaller hypocones than in the Macroscelididæ or Erinaceidæ. On the other hand the upper molars differ from the Tupaiidæ and resemble the latter two families in the external and non-crescentic paracone and metacone.

The lower molars are likewise of rather generalized erinaceoid-tupaioid type but differ from both groups in the short trigonids and in the perhaps more important character of a projecting hypoconulid or incipient third lobe on M_3.

In short, the dentition is peculiar but is not inconsistent with reference either to the Tupaioidea or to the Erinaceoidea. Taken by itself it would be inconclusive but would perhaps seem somewhat more suggestive of the latter group—a conclusion so opposed to the more conclusive osteological characters as to serve as an example of the often misleading character of the teeth alone as guides to family or higher relationships among these primitive groups.

Turning to the entire known structure of *Anagale*, its characters at once exclude near relationship with any but three established groups of mammals: the erinaceoids, the tupaioids, and the more primitive lemuroids. It is probably related to all three, but its closest relationships are clearly with the tupaioids. Some of the more important items of evidence for this view are as follows:

Dentition not inconsistent with tupaioid relationships.

Infraorbital canal relatively small and long.

Orbit large. Open posteriorly (unlike Recent Tupaiidæ) but with strong postorbital process (cf. *Rhynchocyon:* unlike Erinaceidæ and presumably like the ancestral tupaiid condition).

Lachrymal with moderate anterior, not superior, expansion, prominent spine, two foramina (cf. *Tupaia*).

Jugal large, with lachrymal contact and extending posteriorly to the glenoid fossa.

Mastoid exposure lateral rather than occipital.

Large bulla into which the basisphenoid does not enter, probably formed by an entotympanic with annular tympanic internal.

Cerebral hemispheres relatively large and globular.

Pterygoid crests and external pterygoid fossa almost exactly as in *Tupaia*.

Orbitotemporal region not wholly clear, but almost surely with palatolachrymal contact and nasopalatine foramen opposite M_3, as in Tupaiidæ but not in any Lipotyphla.

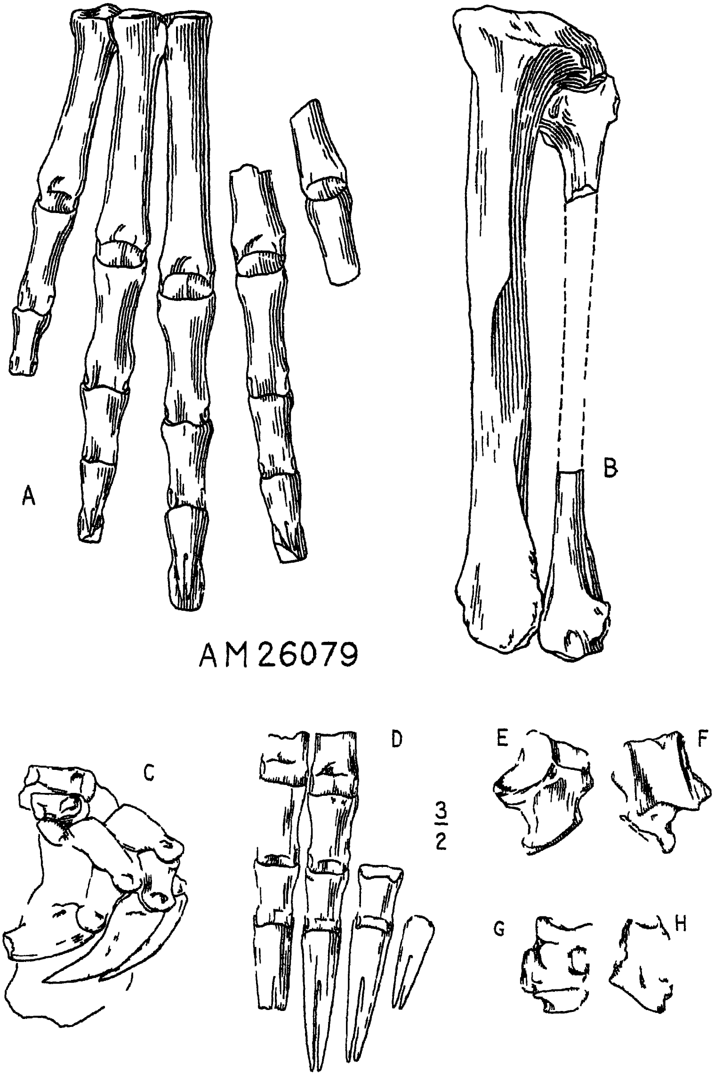

Fig. 5. *Anagale gobiensis*

A, Dorsal view of right pes (partly restored from opposite foot) B, Anterior view of left tibia and fibula C, Outer view (?) of phalanges of right (?) manus, *in situ* D, Dorsal view of phalanges of right (?) manus E, Posterior view of left astragalus F, Anterior view of left astragalus G, Inner view of left cuboid H, Outer view of left cuboid All one and one-half times natural size

Cranial foramina (including alisphenoid canal and carotid foramen) like those of *Tupaia* in every essential.

Vertebræ tupaioid or erinaceoid in fundamental characters, but known parts not very distinctive between the two.

Known parts of fore limb also pointing to these two groups but not distinctive between them.

Tibia and fibula separate, prominent internal malleolus.[1]

Astragalus fundamentally tupaioid, although differing in some features, mostly primitive, as detailed above.

Tarsus and metatarsus not unduly elongate (cf. erinaceoids and Tupaiidæ but not Macroscelididæ).

The points of agreement with the Tupaiidæ are so numerous, so detailed, and so highly diagnostic that there can be no doubt that they indicate a rather close relationship.

On the other hand, this fundamental resemblance in basic character is accompanied by numerous differences of less importance. All of these are sufficiently emphasized in the diagnosis and descriptions above or in the further discussion of affinities below. To some extent these are merely primitive, as the open orbit or complete dental formula. To a very limited degree they are points of special resemblance to the erinaceoids on the one hand or to the lemuroids on the other, while certain of them, as the advanced structure of P^2, large unguals of the manus, or short cuboid, are aberrant specializations.

These resemblances to and differences from the Tupaiidæ seem best expressed by placing *Anagale* in a distinct family, Anagalidæ, of the superfamily Tupaioidea,[2] Order Insectivora. The relationship of the Anagalidæ and the Tupaiidæ seems to be nearly analogous to that of the Leptictidæ and the Erinaceidæ.

Certain other fossil insectivores have been considered as tupaioid or menotyphlan in relationship. The best known of these are the varied genera grouped under the Plesiadapidæ, referred to the Menotyphla by Matthew. This systematic position is supported chiefly by the fact that they, like the tupaiids, have a mixture of primate and of insectivore characters, yet with little or nothing specifically suggestive of the Tupaiidæ. While aberrant in many respects, the primitive primate characters appear to predominate, and I should prefer to follow Stehlin to the extent of referring them to the Primates.[3] This is further supported by the fact that in the known parts (including some skeletal and other material not yet published in detail) they seem to share few or no characters with *Anagale* that are not also shared by undoubted primates.

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[1] Their separation is, of course, primitive but is nevertheless a diagnostic character of great value, since the fused erinaceoid crus was already typically established in the Paleocene.

[2] Customarily referred to the Suborder Menotyphla, but this term was based on the Macroscelididæ, and there is now much doubt as to whether this family can be grouped with the Tupaiidæ.

[3] Although not to a section Cheiromyoidea.

Passing over some genera, especially *Galerix*, once referred to the Tupaioidea in error, there remain several early Tertiary genera sometimes placed here: *Entomolestes*, *Leipsanolestes*, *Adapisorex*. Teilhard (1927) has recently shown that *Adapisorex* is probably a leptictid, and, contrary to my original opinion, I have elsewhere (1929) reached the same conclusion regarding *Leipsanolestes*. The same may be true of *Entomolestes*. In any event, the teeth, an imperfect acquaintance with which constitutes our entire knowledge of these genera, are quite inadequate to prove true tupaiid relationships, and such reference is improbable. As very early probable erinaceoids they are doubtless not far removed from the tupaioid ancestry, but they cannot be referred to the latter group on present evidence. They have no special resemblance to *Anagale*.

Having established the fact that *Anagale* is related to the Tupaiidæ, it is necessary to examine its resemblances to other groups recognized as allies of the tupaiids in varying degrees: Macroscelididæ, Erinaceidæ, Leptictidæ, and lower lemuroids (Adapidæ, Notharctidæ, Lemuridæ).

Macroscelides, *Rhynchocyon*, and their allies form an aberrant group combining with many peculiar features of their own numerous characters otherwise found in the Tupaiidæ or Erinaceidæ but not in both. The general conclusion is fairly clear: that the Tupaiidæ and Erinaceidæ are derived from a common source, that they separated at some very early time (probably Paleocene or earlier), and that the Macroscelididæ are also derived from this common ancestry. The characters of the Macroscelididæ which resemble now one family and now the other are thus either (a) characters of the common tupaiid-erinaceid ancestry now lost in one group or the other, or (b) characters secondarily convergent toward one group or the other, or (c) characters developed either in the Erinaceidæ or in the Tupaiidæ after they had become separate. Upon the characters placed in category (c) depends whether the Macroscelididæ are to be considered as belonging to the Tupaioidea or to the Erinaceoidea, or neither. Most authorities place the tupaioid characters in this category, that is, they consider that the Macroscelididæ were derived from the tupaiid ancestry after the latter had diverged from the erinaceid ancestry. Careful study, however, led Albertina Carlsson to the opposite view of especial erinaceoid affinities. In the absence of fossil macroscelidids, the evidence is so evenly balanced that its interpretation depends on mere personal opinion as to the nature, importance and antiquity of the various characters. Tabulation of numerous characters shows the following facts as to the bearing of *Anagale* on this problem:

1. *Anagale* already possessed all the characters shared by Tupaiidæ and Macroscelididæ.
2. It also possessed numerous definitely tupaiid characters (such as details of cranial foramina, bullæ, tibia and fibula, and astragalus) not found in the Macroscelididæ.
3. Characters shared by *Anagale* and the Macroscelididæ but not by the Tupaiidæ are few and are either primitive (as the open orbit and absence of molar foramen) or superficial and adaptive (as the long dorsal spines) and of no great phylogenetic significance.

As regards *Anagale* itself, it is seen that it is much closer to the Tupaiidæ than to the Macroscelididæ and that it is in no sense intermediate between the two. It produces no rapprochement of the two groups beyond showing the antiquity of the characters shared by them, but on the other hand does not tend to separate them more widely.[1]

The existence of a body of evidence tending to link the Tupaiidæ and the Erinaceidæ through a very remote common ancestry has long been generally recognized, as suggested above. *Anagale* bears on this point as follows:

1. It has most or all of the primitive characters retained in the Erinaceidæ but lost in the Tupaiidæ.
2. Except for a few, masked by its own divergent specialization (as by the shortened trigonids or the proximodistally compressed tarsus), it also has all the special characters shared by the Tupaiidæ and Erinaceidæ.
3. It also has a few special and non-tupaiid resemblances to the Erinaceidæ (such as those of the teeth or of the astragalus, detailed above).

The first fact tends to show the simple divergence in time of the Tupaiidæ. The second suggests that the tupaiid–erinaceid resemblance is one of true affinity and not of convergence. The third, although not very striking, tends in a limited degree to draw the two groups closer together.

More important evidence of the relationships between tupaiids and erinaceids may be furnished by the extinct (Cretaceous to Oligocene) American family Leptictidæ. This family is quite distinct from the Erinaceidæ, but is definitely erinaceoid in general structure. At the same time it has some points of definite resemblance to the Tupaiidæ not seen in the erinaceids. Full elucidation would require a monographic revision of the Leptictidæ, and the general problem has been briefly discussed by Gregory, so that it will be enough here to show that *Anagale* is not a member of this family but that these special resemblances do exist.

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[1] More detailed discussion would be out of place here, but the examination of dental and osteological characters incidental to the present study has led to the personal impression that the resemblances in these characters between the Macroscelididæ and the Tupaiidæ are rather more important, those between the former and the Erinaceidæ rather less important, than was concluded by Carlsson. In either event the Macroscelididæ are an extraordinarily aberrant group.

Anagale is excluded from the Leptictidæ, not only by the erinaceoid characters of the latter, such as the short and dorsal lachrymal expansion, occipital mastoid exposure, false bulla, fused tibia and fibula, and many others, but also by many of the peculiarly leptictid characters, such as the truly molariform P^4, intraorbital lachrymal foramen, squamosal foramina, club-shaped spine of the axis, etc.

There is a special resemblance in the teeth, although neither consistent nor detailed, in that M^{1-2} of the Leptictidæ are subquadrate and transverse, paracone and metacone external and non-crescentic, trigonids of lower molars short, M_3 talonid with projecting hypoconulid. The skull also has a few points of resemblance, such as the unpierced but large jugal and the rather similar alisphenoid canal. The leptictid tibia and fibula are fused, as in erinaceids, yet do not articulate with the calcaneum and have a well developed internal malleolus, as in *Anagale* and the tupaiids. The astragalus is in some respects intermediate between the tupaiid and erinaceid types, but not especially close to *Anagale*. It has the trochlea continuous to the posterior margin (although more deeply grooved than in tupaioids), strong internal malleolar facet, and sharp crests with the fibular somewhat higher—all points more or less suggestive of the tupaiids. Unlike *Anagale*, there is no astragalar foramen. Despite these and other resemblances, it is clear that the Leptictidæ and Anagalidæ, and hence likewise the Erinaceoidea and Tupaioidea, diverged long before the Oligocene.

As early as 1886, Parker made note of resemblances between the tupaioids and the lemuroids. Many subsequent studies have finally established the view that the tupaiids are the closest living relatives of the primates and that they cast considerable light on the origin of the latter. The recent detailed work of W. K. Gregory (esp. 1910, 1913), W. E. Le Gros Clark (1926) and Albertina Carlsson (1922) make unnecessary any general review of the evidence, but it is of importance to examine *Anagale*, the oldest definitely recognizable tupaioid, with this problem in mind.

Anagale has all the observable primate-like characters of *Tupaia*, with the following chief exceptions:

1. Open orbit.
2. No malar foramen.

3. Astragalar foramen.
4. Separate sustentacular and navicular facets on astragalus.
5. Relatively shorter phalanges.
6. Large claws on manus.
7. Shorter cuboid.

The first four characters are primitive, although it would have been supposed, *a priori*, that they would be lost in the common ancestry of the primates and the tupaioids. The last three are rather unimportant habitus characters of *Anagale*.

On the other hand, there is an equally or more important assemblage of characters in which *Anagale* approaches the primitive primates more closely than do the recent tupaiids:

1. Dentition distinctly more primate-like:
    a. P$\frac{4}{4}$.
    b. Premolars more affected by molarization.
    c. Upper molars subquadrate.
    d. Paracone and metacone less crescentic and more external.
    e. Trigonids short and narrower than talonids.
    f. Lemuroid projection of hypoconulid on M_3.
2. Shorter premaxilla.
3. Shorter facial expansion of lachrymal.
4. More prominent lambdoid crest.
5. Bullæ more spherical and with large auditory openings.
6. Fibula stouter and more curved.
7. Unguals of pes flattened and spatulate distally.

In view of its geologic age and general morphology, it is obvious that *Anagale* is not ancestral to any primate, and that it belongs definitely in the tupaioid line long after the separation of the primates. Some of these lemuroid characters are very probably convergent, yet the existence of such resemblances is just what one would expect in an early tupaioid offshoot, on the theory that these represent the protolemuroid stock. The existence in *Anagale* of all of the lemur-like characters of the tupaioids, with the rather trivial exceptions noted above, further strengthens this view and lessens the probability of these characters, in so far as common to all tupaioids, being to any significant degree convergent.

Carlsson has proposed that the tupaioids be removed from the Insectivora and made a suborder of Prosimiæ, while Gregory (1910) has made a separate Order Menotyphla. This really involves no great change from the accepted view of *Tupaia* and its allies as structurally intermediate between insectivores and primates, and the classification depends on personal emphasis of different aspects of the evidence. Yet the various resemblances of *Anagale* and of different groups of insectivores as set forth here seem to me to support the classical retention of the Tupaioidea in the Insectivora as the more convenient arrangement.

RÉSUMÉ

1. *Anagale gobiensis*, new genus and species, is described on the basis of remarkably well preserved skull and jaws and much of the skeleton.

2. It is shown to be closely related to the Tupaiidæ but referable to an extinct and non-ancestral family Anagalidæ.

3. It is not closely related to any previously known fossil insectivores, none of which appears to be certainly referable to the Tupaioidea.

4. It is not intermediate between the Tupaiidæ and Erinaceidæ, being definitely allied with the former, but tends in some degree to strengthen the evidence of their remote common origin.

5. It tends more definitely to link the Tupaioidea and the Lemuroidea.

6. But it proves that the Tupaioidea have been distinct from all other groups of mammals from a time long antecedent to the basal Oligocene.

REFERENCES

Berkey, C. P., Granger, W., and Morris, F. K. 1929. 'Additional new formations in the later sediments of Mongolia.' Amer. Mus. Novitates, No. 385.

Carlsson, A. 1909. 'Die Macroscelididæ und ihre Beziehungen zu den übrigen Insectivoren.' Zool. Jahrb., Abt. Syst. etc., XXVIII, 349-400.

1922. 'Über die Tupaiidæ und ihre Beziehungen zu den Insectivora und den Prosimiæ.' Acta Zoolog., III, 227-270

Clark, W. E. Le Gros. 1925. 'On the skull of *Tupaia*.' Proc. Zool. Soc. London, 1925, 559-567.

1926. 'On the anatomy of the Pen-tailed Tree-shrew (*Ptilocercus lowii*).' Proc. Zool. Soc. London, 1926, 1179-1309.

Dobson, G. E. 1882-3. 'A Monograph of the Insectivora.' London.

Douglass, E. 1906. 'The Tertiary of Montana.' Mem. Carn. Mus., II, 203-223. [*Ictops*].

Gregory, W. K. 1910. 'The orders of mammals.' Bull. Amer. Mus. Nat. Hist., XXVII, 1-524.

1913. 'Relationship of the Tupaiidæ and of Eocene lemurs, especially *Notharctus*.' Bull. Geol. Soc. Amer., XXIV, 241-252.

1920. 'On the structure and relations of *Notharctus*, an American Eocene primate.' Mem. Amer. Mus. Nat. Hist., N.S., III, 49-243.

Leche, W. 1902. 'Zur Entwicklungsgeschichte des Zahnsystems der Säugethiere. 2ter Theil, Phylogenie. 1stes Heft, die Familie der Erinaceidæ.' Zoologica, XXXVII, Pl. II, Sect. 1, 1-103.

LYON, M. W., JR. 1913. 'Treeshrews: an account of the mammalian family Tupaiidæ.' Proc. U. S. Nat. Mus., XLV, 1–183.

MATTHEW, W. D. 1909. 'The Carnivora and Insectivora of the Bridger Basin, Middle Eocene.' Mem. Amer. Mus. Nat. Hist., IX, 291–567.

1917. 'The dentition of *Nothodectes*.' Bull. Amer. Mus. Nat. Hist., XXXVII, 831–839.

1915, 1918. 'A revision of the Lower Eocene Wasatch and Wind River faunas. Insectivora.' Bull. Amer. Mus. Nat. Hist., XXXIV, 456–483; XXXVIII, 565–613.

MATTHEW, W. D., AND GRANGER, W. 1924. 'New insectivores and ruminants from the Tertiary of Mongolia, with remarks on the correlation.' Amer. Mus. Novitates, No. 105.

MATTHEW, W. D., GRANGER, W., AND SIMPSON, G. G. 1929. 'Additions to the fauna of the Gashato Formation of Mongolia.' Amer. Mus. Novitates, No. 376.

OSBORN, H. F. 1929. '*Embolotherium*, gen. nov., of the Ulan Gochu, Mongolia.' Amer. Mus. Novitates, No. 353.

PARKER, W. K. 1886. 'On the structure and development of the skull in the Mammalia. Pt. III. Insectivora.' Phil. Trans. Roy. Soc. London, CLXXVI.

SIMPSON, G. G. 1928. 'Affinities of the Mongolian Cretaceous insectivores.' Amer. Mus. Novitates, No. 330.

1929. 'A collection of Paleocene mammals from Bear Creek, Montana.' Ann. Carn. Mus., XIX, 115–122. [*Leipsanolestes*].

STEHLIN, H. G. 1912, 1916. 'Die Säugetiere des Schweizerischen Eocaens.' 7ter Teil. Abh. schweiz. pal. Ges., XXXVIII, 1165–1298; XLI, 1299–1552.

TEILHARD DE CHARDIN, P. 1927. 'Les mammifères de l'Eocène inférieur de la Belgique.' Mém. Mus. Roy. Hist. Nat. Belg., No. 36.

WEBER, M., AND ABEL, O. 1928. 'Die Säugetiere.' Bd. II. Systematischer Teil. 2te Aufl. Jena.

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NEW AFRICAN CALLIPHORIDÆ (DIPTERA)

BY C. H. CURRAN

In the following pages I present descriptions of twenty-five species of Calliphoridæ from Africa. Inasmuch as the collections before me contain most of the described species from the region, it is hoped that an opportunity may be found in the near future to review the family as a whole and thus bring together, in one paper, the numerous representatives of the family occurring in Africa. The types of the new species, unless otherwise stated, are in The American Museum of Natural History.

Strongyloneura cupreithorax, new species

Black; antennæ red; thorax cupreous, thinly pollinose, abdomen with cupreous and greenish reflections. Length, 11 to 11.5 mm.

FEMALE.—Head black in ground color, clothed with cinereous-white pollen, the cheeks and facial ridges wine-red; a broad anterior band on the cheeks and the lower third of the parafacials shining. Front broad, gradually widening anteriorly, the parafrontals at their middle half as wide as the brown frontal vitta; frontal bristles moderately strong, the two upper pairs reclinate; three or four proclinate orbitals, the hair coarse and sparse, each hair and bristle arising from a tiny shining spot. Ocellars moderately strong; outer verticals more than half as long as verticals; no black setæ behind the occipital cilia. Cheeks and occiput pale yellow pilose. Parafacials as wide as the length of the third antennal segment, with sparse, coarse black hair. Palpi reddish brown, becoming red apically. Antennæ reddish, the basal segment stained with brown; facial carina very broad, convex, extending to the middle of the face.

Thorax blackish with very strong cupreous reflections, thinly cinereous pollinose, the vittæ indistinct. Hair black, the pleura yellow pilose except on the mesopleura. Acrosticals 1–3; dorsocentrals 2–4; two sublaterals and two posthumerals; three intra-alars; four pairs of marginal scutellars and two pairs of subdiscals; sternopleurals 1–1.

Legs black, the femora and coxæ with cinereous pollen; tibiæ reddish, their apices darker. Hair black, the fine hair on the coxæ yellowish; anterior coxæ with black bristles on their whole length.

Wings tinged with brown which is especially noticeable along the veins on the apical half, the base rather luteous. Squamæ large, cinereous white, the lower lobe produced inwardly to beneath the edges of the scutellum.

Abdomen blackish, with strong greenish tinge, and rather thickly cinereous pollinose, the pollen somewhat tessellate; a narrow blackish vitta extends from the base of the abdomen to the apex of the third segment and the rather narrow segmental apices appear black in some lights. The fourth segment bears a large cupreous triangle on either side which is produced inwardly along the base of the segment and there are indications of a similarly colored, transverse spot on the base of two preceding segments at either side. Hair black, the basal sternite yellowish-haired. Fourth segment with an irregular row of discal bristles across the middle, the apical bristles rather fine.

TYPES.—Two females from Barberton, Transvaal, the holotype taken on July 15, 1920, the paratype on July 14, 1920 by Mr. H. K. Munro. The type has been returned to Mr. Munro.

This species differs from *connivens* Villeneuve in having a blackish prothoracic spiracle and from *villeneuvei* Curran by the cupreous thorax.

Strongyloneura varians, new species

Related to *tristis* Bigot but the mesonotum bears much narrower dark vittæ and a strong cupreous tinge is evident beneath the cinereous pollen; the veins on the apical half of the wing are clouded with brown and the yellow hair of the occiput extends on to the cheeks. Black, cinereous pollinose; tibiæ reddish. Length, 9 to 10 mm.

MALE.—Head with the soft parts of the face and the facial ridges reddish in ground color, wholly pollinose, with only small bare spots on the lower part of the parafacials and upper part of the cheeks. About seven pairs of frontals, the upper ones weak. Frontal vitta brown, the eyes separated by a distance less than twice that between the posterior ocelli; parafrontals with two irregular rows of black hairs; ocellars strong. Occiput yellow-haired, the pale hair extending on to the posterior part of the cheeks. Cheeks and parafacials with black hair, the parafacials moderately wide. Palpi brown, their apical third reddish. Antennæ reddish brown, the third segment about half reddish, long, the antennæ reaching almost to the vibrissæ. Facial carina high but narrow.

Thorax cinereous pollinose, with rather strong cupreous tinge beneath the cinereous pollen; three rather narrow, anteriorly abbreviated dark vittæ. Hair black, the fine hair on the sternopleura yellowish. Acrosticals 2–2; dorsocentrals 2–4; two sublaterals; three intra-alars; two posthumerals; three pairs of marginal scutellars; sternopleurals 1–1.

Legs black, the femora cinereous pollinose; hair wholly black; tibiæ reddish; pulvilli moderately long, brown.

Wings with brownish tinge, the veins on the apical half strongly bordered with brown. Squamæ with yellow tinge, not produced inwardly although convex.

Abdomen black, cinereous pollinose, in some lights with cupreous reflections laterally. An obscure median vitta and the apices of the segments appear pollinose in some views; pollen very weakly tessellate. Hair and bristles black, yellow on the first sternite. Each segment bears several lateral median bristles, those on the fourth strong, the fourth without discals medianly.

FEMALE.—The pollen has a yellowish tinge. Front moderately wide, the brown frontal vitta slightly wider than either parafrontal; about seven pairs of frontals, the upper pair reclinate; two pairs of strong orbitals. Black vittæ of the mesonotum slightly narrower. Median bristles on the sides of the abdominal segments not quite as numerous, the fourth segment with a transverse row of bristles near the basal third.

TYPES.—Holotype, male, Victoria Falls, August 25, 1920; allotype, female, Victoria Falls, August 26, 1920; paratype, female, Victoria Falls, August 29, 1920, all collected by Mr. H. E. Irving. The types have been returned to Mr. H. K. Munro.

Strongyloneura congensis, new species

Related to *tristis* Bigot from which it differs by possessing only one pair of presutural acrostical bristles and the bluish coloration. Blackish blue, with cinereous pollen, the mesonotum rather weakly vittate. Length, 9 mm.

FEMALE.—Head with cinereous-white pollen, the parafrontals and parafacials appearing silvery in some lights; parafacials below, and a large spot on the front of the cheeks shining black. Front rather narrow, the brown frontal vitta wider than either parafrontal; about nine pairs of frontals, the upper pair reclinate; two pairs of strong orbitals; hair on the parafacials coarse, in two irregular rows, the inner row bristle-like. Occiput with yellowish hair which does not encroach upon the cheeks. Cheeks and the moderately narrow parafacials with black hair. Palpi brown. Antennæ reddish brown, long, not quite reaching the vibrissæ. Facial carina moderately narrow.

Thorax blue-black, rather thinly cinereous pollinose especially on the posterior portion of the mesonotum, the median dark vitta distinct in front, the others indistinct. Acrosticals 1–2; dorsocentrals 2–4; two sublaterals; three intra-alars; two posthumerals; three pairs of marginal scutellars; sternopleurals 1–1. Hair wholly blackish.

Legs black; tibiæ brown; hair wholly black; coxæ cinereous pollinose, the femora with thin brownish-gray pollen.

Wings cinereous, the veins bordered with light brown; basicosta blackish. Squamæ reddish brown, whitish on the basal half, the lower lobe gently convex on the inner side but not strongly produced.

Abdomen blue-black, moderately pollinose, the pollen quite conspicuous on the fourth segment, weakly tessellate on the intermediate segments. Hair and bristles black, pale on the basal sternite. Fourth tergite with a medianly interrupted row of discals.

HOLOTYPE.—Female, Burunga, Congo (J. Bequaert).

OBSCURIA Malloch

MALLOCH, 1925, Ann. Mag. Nat. Hist., XVI, p. 95 (Type: *spinicosta* Malloch).

Only one species has been described in this genus, and it is characterized by the absence of prescutellar acrosticals and three sternopleural bristles. The species before me does not agree in these characters, having only two sternopleurals and a pair of prescutellar acrosticals. Nevertheless it probably belongs in the genus, since neither of these characters is of generic importance. The two species are separable as follows:

a.—Sternopleurals 2–1; acrosticals 0–0; tibiæ reddish yellow; "eyes almost bare." *spinicosta* Malloch.

b.—Sternopleurals 1–1; acrosticals 0–1; legs wholly blackish; eyes bare. *incerta*, n. sp.

Obscuria incerta, new species

Black, with brownish-gray pollen, the wings strongly tinged with brown. Length, 3.5 to 4.25 mm.

MALE.—Head black, moderately grayish pollinose, the parafacials with a brownish area above; soft parts of the face dark reddish. Eyes separated by a distance slightly less than that between the posterior ocelli, widening in front and behind; frontal vitta brownish red anteriorly; about seven pairs of frontals; ocellars strong; outer verticals absent; hair on the head wholly black. Cheeks almost half as wide as eye-height. Parafacials moderately wide, with a few scattered hairs on the lower half. Palpi blackish. Antennæ brown, the third segment pollinose, reaching three-fourths the distance to the vibrissæ, which are situated almost level with the oral margin. Eyes quite bare.

Pollen of the thorax more brownish dorsally, the hair black. Acrosticals 0–1; dorsocentrals 2–3; one sublateral, the posterior one absent; two or three intra-alars; no posthumeral; three pairs of marginal scutellars, the apical pair decussate; sternopleurals 1–1.

Legs black, the coxæ thinly pollinose. Hair and bristles black. Pulvilli small, whitish.

Wings strongly tinged with brown, paler posteriorly. Squamæ brown, narrow. Halteres brown.

Abdomen shining, moderately grayish-brown pollinose, with a dark median vitta on the basal three segments. Hair and bristles black. Abdomen without discals; third and fourth segments each with a row of strong marginals, the second with an interrupted row of weaker marginals.

TYPES.—Holotype, male and one male paratype, Burunga, Congo (J. Bequaert).

Pericallimyia bequaerti, new species

Related to *spinigera* Villeneuve but at once distinguished by the bright orange abdominal apex. Length, 5 to 7 mm.

MALE.—Head black, with cinereous pollen which becomes silvery white in certain lights; in profile there is a silvery spot opposite the antennæ, a large one on the lower half of the parafacials and two on the cheeks; hair wholly black. About fourteen pairs of frontals, the upper ones becoming finer; ocellars long; several of the occipital cilia on the upper fifth unusually long. Cheeks one-fourth as wide as eye height. Parafacials of moderate width, with fairly long fine hairs on the upper third. Facial ridges with fine bristles on more than the lower half, the vibrissæ situated almost level with the produced oral margin. Palpi blackish. Antennæ black, four-fifths as long as the face. Eyes bare, separated by a distance equal to the width of the frontal triangle.

Thorax blue-black, moderately pollinose, less thickly so on the posterior half of the mesonotum which bears three moderately distinct dark vittæ. Acrosticals 2–3; dorsocentrals 2–3; two sublaterals; two intra-alars; one posthumeral; three pairs of marginal scutellars, the apical pair finer and decussate; sternopleurals 1–1. Hair wholly black.

Legs black; coxæ thickly, the femora thinly cinereous pollinose. Pulvilli short, yellowish brown.

Wings cinereous hyaline, with brownish tinge, the base broadly and a large spot on the anterior cross-vein deep brown. Squamæ brown with white rim. Halteres reddish yellow.

Abdomen blackish blue, the basal half of the second and third segments with tessellate grayish pollen; apical half of the fourth segment orange. Second and third segments without discals, the second with one pair, the third with a row of strong marginals; fourth segment with discal and marginal row of much finer bristles. Hair long and black, thick on the sternites. Genitalia black.

Female.—Front with parallel sides, the brown frontal vitta much wider than either parafrontal; seven pairs of frontals, the upper pair reclinate; two pairs of orbitals, the upper pair weak; outer verticals long; occipital cilia without unusually long bristles above. Hair on parafacials short and not conspicuous. Thorax and abdomen dark bluish or violaceous, the bristles on the fourth abdominal segment stronger, the hair wholly shorter. The brown markings on the wings are less distinct, the spot on the cross-vein being small. The costal spine is longer and stronger than in the male.

Types.—Holotype, male, Bebungi, Uganda, April 4, 1927; allotype and paratype, two females, Burunga, Congo (J. Bequaert).

Paratricyclea muscoidea, new species

Black, with cinereous and brown pollen, the cross-veins clouded with brown. Length, 8 mm.

Male.—Head black, cinereous-white pollinose, from lateral view with a dull black spot between the base of the antennæ and the orbit. Eyes separated by a slightly greater distance than that between the posterior ocelli; frontal vitta dull black; nine pairs of frontals; ocellars long; outer verticals distinct, hair of the central part of the occiput cinereous. Cheeks more than one-third as wide as the eye-height, the hair coarse and black; two or three bristles in front. Parafacials of moderate width, with two or three hairs below the frontal bristles. Palpi reddish brown. Antennæ blackish brown, reaching the lower fourth of the face, the third segment twice as long as the second. Vibrissæ situated slightly above the oral margin.

Thorax cinereous pollinose, the mesonotum brown, with a pair of dorsocentral vittæ and the lateral margins broadly gray, the disc of the scutellum also brown. Acrosticals 0–1 or 2; dorsocentrals 2–3; two sublaterals, no posthumerals; two intra-alars; three pairs of marginal scutellars; sternopleurals 2–1. Hair black except on the propleura.

Legs black, black-haired; coxæ gray pollinose; femora thinly brownish-gray pollinose; tibiæ brownish red; pulvilli reddish brown, elongate.

Wings tinged with brown, the veins slightly, the cross-veins strongly, clouded. Squamæ tinged with brown, the base white. Knob of halteres yellow.

Abdomen narrowly oval, twice as long as wide, subcylindrical, cinereous pollinose above, the dorsum with a brown vitta interrupted at the sutures and with a large, subtriangular brown spot on each segment which may be more or less united with the median vitta posteriorly; venter wholly brown except laterally. Hair black; no discal bristles and no median laterals, third and fourth segments each with a row of strong marginals, the second with strong marginals laterally and four weak ones on the median portion. Genitalia small, brownish gray.

Type.—Male, Kabale, Uganda, April 9, 1927 (J. Bequaert).

This species is related to *stabulans* Bezzi but the color, longer abdomen and much more strongly clouded cross-veins will at once distinguish it. *P. stabulans* has reddish femora, partly reddish abdomen and reddish scutellum.

Paratricylea metallica, new species

A metallic blue and green species, with reddish tibiæ and the lower squamal lobe transverse at the apex and slightly produced on the inner side. Length, 5.5 mm.

MALE.—Head black, cinereous-white pollinose. Eyes separated by slightly less than the distance between the posterior ocelli; frontal vitta dull black; eight or nine pairs of frontals, the upper ones weak; ocellars long and strong; hair black, pale on the occiput below the neck. Cheeks a little more than one-third as wide as the eye-height. Parafacials moderately narrow, without hairs. Palpi reddish. Antennæ brownish red, the third segment brown, reaching the lowest fourth of the face.

Thorax metallic blue, thinly cinereous pollinose, not vittate. Acrosticals and dorsocentrals 2–3; two sublaterals; one posthumeral; three intra-alars; four pairs of marginal scutellars, the sub-basal pair weak; sternopleurals 2–1. Hair black.

Legs black, the tibiæ and basal one or two tarsal segments reddish; coxæ thinly pale pollinose; pulvilli small, cinereous.

Wings cinereous hyaline. Squamæ brown with luteous base and margin, the lower lobe transverse apically, sharply rounded at the corners, almost straight on the inner margin and slightly produced inwardly. Halteres yellow.

Abdomen metallic green, the first segment blackish blue; an obscure, broad vitta on the second segment and the narrow apices of the second and third, appearing blackish in some lights; second to fourth segments thinly white pollinose, the third and fourth each with a row of strong marginals; second and third segments with two to four median lateral bristles. Genitalia brown. Abdominal hair wholly black.

HOLOTYPE.—Male, Balla-Balla, S. Rhodesia, February, 1931 (A. Cuthbertson), No. 519.

This species is apparently related to *cœrulea* Villeneuve but the presence of only three pairs of postsutural dorsocentrals will at once distinguish it.

Tricyclea kasatana, new species

Rusty reddish yellow, the mesonotum, except laterally, and abdominal markings black. Length, 7 mm.

FEMALE.—Head yellowish, whitish pollinose. Front with parallel sides; six or seven pairs of decussate frontals and a proclinate pair above; ocellars and outer verticals strong; occipital cilia black. Hair of the front short and black; some of the hairs on the upper part of the cheeks, sometimes most of those on the anterior half, black, the hair otherwise fine and yellow. Cheeks a little more than one-third as wide as eye-height. Parafacials quickly tapering so that the soft part is extensive, the hairs very small and not easily seen; facial ridges bristled slightly more than halfway. Palpi pale orange, very large, spoon-shaped, with many short, coarse, black hairs. Antennæ pale orange, the arista black except basally.

Thorax yellowish, moderately cinereous pollinose, the mesonotum black with broadly yellow sides. On the mesonotum the pollen, in certain lights, leaves six narrow, bare vittæ but they are not at all conspicuous. Acrosticals 3–3; dorsocentrals 3–4; two sublaterals, the inner posthumeral present, the outer absent; three intra-alars; four or five pairs of marginal scutellars; sternopleurals 1–1. Hair of the dorsum black, of the pleura yellow, the mesopleura with two rows of black bristles above. Scutellum yellow.

Legs reddish yellow, the apical one or two tarsal segments brown. Hair and bristles black.

Wings tinged with yellow. Squamæ cinereous yellow. Halteres yellow.

Abdomen rusty reddish-yellow, with black markings as follows: a very narrow, incomplete and broadly interrupted fascia on the first segment, broad fasciæ on the second and third segments which are wide in the middle and narrow laterally, and a transverse, oval spot on either side of the apex of the fourth segment. At their widest point the bands on the second and third segments occupy about the posterior third of the segment. In some lights there is a faint white bloom on the abdomen but it is usually shining. Hair black, fine and yellow only on the base of the venter.

TYPES.—Holotype, female, Kasata, Liberia, September 29, 1926; paratype, female, Memeh Town, Liberia, August 29, 1926 (J. Bequaert).

This may prove to be *evanida* Villeneuve but is not the same as the species so identified by Malloch. In *evenida* Malloch the outer posthumeral bristle is present, so that there are five bristles in the presutural lateral area, whereas in *kasatana* the outer posthumeral is absent.

Tricyclea major, new species

The largest species in the genus. It resembles *fasciata* Macquart but has the thorax wholly pale, the mesonotum being rusty reddish. The costal border is brown beyond the auxiliary vein to a little beyond the apex of the second vein, with a broad yellowish streak bordering on the first vein behind, the wings otherwise with a luteous tinge. *T. semithoracica* Villeneuve has the mesonotum largely black in front of the suture and is a smaller species. Length, 9.5 mm.

FEMALE.—Head yellowish, whitish pollinose; frontal vitta, antennæ, palpi and proboscis orange. Front narrow, with almost parallel sides, a little widened on the upper fourth where the sides and ocellar triangle are blackish in ground color. Seven pairs of decussate, one pair of divergent and one pair of proclinate frontals; ocellars strong; outer verticals almost as strong as the verticals. Upper half of the occiput black in ground color. Cheeks about one-fourth as wide as eye-height, wholly black-haired. Parafacials with a row of tiny black hairs above. Facial ridges with short bristles on the lowest three-fourths. Palpi of moderate size, bearing coarse, very short black hairs.

Thorax with faint velvety-yellow sheen when seen from in front. Acrosticals 3–3; dorsocentrals 2 or 3–4; two sublaterals; two posthumerals; three intra-alars and a bristle between the smaller anterior intra-alar and the pre-alar, these last three bristles all of about the same size; five or six pairs of marginal scutellars; sternopleurals 1–1. Thorax with black hair, the pleura mostly reddish yellow pilose.

Legs reddish, the tarsi becoming brown apically; hair and bristles black.

Wings luteous hyaline, the costal border brownish from the apex of the auxilliary vein to a little beyond the apex of the second vein but with a luteous stripe lying immediately behind the first vein and extending a short distance along the costa. Squamæ brownish yellow, the border orange. Halteres yellow.

Abdomen shining rusty yellowish, the narrow apex of the first segment brown; second segment with a shining black posterior fascia occupying about one-third the segment in the middle and narrowing to about one-fifth at the sides; third segment with the posterior half shining black, the black fascia somewhat expanded in the middle; fourth segment shining black with a very broad reddish median vitta which expands moderately posteriorly and extends along the anterior margin half-way to the lateral margins. Hair black except on the basal sternites.

HOLOTYPE.—Female, Paiata, Liberia, October, 1926 (J. Bequaert).

Tricyclea du, new species

Black and rusty yellowish, the brown costal markings extending from the auxilliary vein almost to the apex of the wing. Length, 6.5 mm.

MALE.—Head rusty yellow, mostly shining, the parafacials thinly yellowish pollinose; upper half of the head black. Eyes with enlarged facets above, barely separated for more than one-third the length of the front; five pairs of frontals, restricted to the lowest third; ocellars strong; outer verticals absent. Cheeks slightly more than one-fourth as wide as the eye-height, with moderately long coarse black hairs. Parafacials narrow, with a row of tiny black hairs above. Facial ridges with short bristly hairs on the lower half. Palpi yellow, normal; proboscis reddish brown. Antennæ reddish yellow, the third segment somewhat darkened above.

Thorax rusty reddish-yellow, the mesonotum brown except laterally and posteriorly, and with a broad, paler median vitta; scutellum brown with the free border broadly yellowish. Acrosticals 3–3; dorsocentrals 2–4; sublaterals, 2; posthumerals 2; three intra-alars; four or five pairs of marginal scutellars; sternopleurals 1–1. Hair wholly black.

Legs reddish, the apices of the posterior four femora and the tarsi with the exception of the basal segment, brown. Hair wholly black. Pulvilli small, whitish.

Wings cinereous hyaline, tinged with brown on the apical half, the costal border brown from the apex of the auxilliary vein to the apex of the wing. Squamæ with brownish tinge, translucent whitish basally. Halteres yellow.

Abdomen rusty yellowish, the apex of the first segment brown, the second shining black on the apical third, third segment shining black on the posterior two-thirds, the black band narrowing toward the sides, fourth with a large black triangle on either side occupying the posterior half and separated from each other by a moderately broad stripe. Hair black except on the basal half of the first sternites.

HOLOTYPE.—Male, Du River Camp No. 3, Liberia, 1926 (J. Bequaert).

Related to *fasciata* Macquart but at once distinguished by the mostly brown scutellum and more extensively brown wings.

Tricyclea liberia, new species

Related to *du*, new species, but the brown costal border begins at the apex of the first vein and is narrower, and the posterior forceps are longer and turned strongly upward apically. Length, 6.25 mm.

Male.—Head pale reddish-yellow, thinly yellowish pollinose; upper half of the front and two-thirds of the occiput black. Eyes almost touching for one-third the length of the front; five or six pairs of short frontals limited to the lowest third; ocellars short and weak. Cheeks about one-fourth as wide as the eye-height, black-haired. Parafacials narrow, with a row of tiny black hairs above. Palpi slender, only a little enlarged apically; proboscis brown. Antennæ reddish yellow. Facial ridges with very short black bristly hairs on the lower half.

Thorax rusty yellowish, the mesonotum rusty reddish with the median half black on the anterior two-thirds although there are indications of three reddish vittæ within the black area. The cinereous pollen is evident only in front of the suture and on the pleura. Acrosticals 3–3; dorsocentrals 2–4; two sublaterals; two posthumerals; three intra-alars, the bristle inside the prealar weak; four or five pairs of marginal scutellars; sternopleurals 1–1. Hair black. Scutellum brown with the free border very broadly yellow.

Legs reddish yellow, the tarsi brown beyond the first segment. Hair black. Pulvilli small, whitish.

Wings cinereous hyaline, the costal border broadly brown beyond the apex of the first vein to the apex of the wing. Squamæ tinged with brown, their base whitish. Halteres yellow.

Abdomen rusty yellowish. First segment with a broadly interrupted, incomplete brown posterior fascia; second segment black on a little more than the apical fourth, the third with the apical third in the middle, less laterally, black; fourth segment with a large, posterior black spot on either side. Hair black except on the basal sternite. Genitalia reddish yellow. The abdomen is without conspicuous pollen.

Holotype.—Male, Reppo's Town, Liberia, September 1, 1926 (J. Bequaert).

Tricyclea confusa, new species

Tricyclea bivittata Malloch, 1929, (not Curran), Ann. Mag. Nat. Hist., III, p. 567.

Rusty reddish and yellowish, with black markings; costal border broadly brown from the apex of the auxilliary vein almost to the third vein, partly interrupted beyond the apex of the first vein. Length, 6 to 6.5 mm.

Female.—Head pale rusty-reddish, the upper three-fourths of the front and the occiput to the lower level of the eyes black. Front wide above, narrowed on the lower third; eight pairs of decussate frontals, one pair of divergent and one pair of reclinate; ocellars moderately strong; outer verticals almost as strong as the verticals. Occiput rather thickly gray pollinose. Cheeks almost one-third as wide as the eye-height, shining, black-haired. Parafacials narrow, with a row of tiny black hairs above. Facial ridges with short bristly hairs on about the lower half. Palpi normal, reddish, proboscis brown. Antennæ reddish, the third segment mostly brown.

Thorax rusty reddish, the mesonotum darker, sometimes with a large brown area on the disc in front of the suture, from which there is a prolongation on either side, or almost unicolorous. Pollen on the dorsum rather thin, brownish yellow, on the pleura cinereous. Acrosticals 3–3; dorsocentrals 2–4; sublaterals 2; two posthumerals; three intra-alars, the bristle inside the pre-alar well developed; four or five pairs of marginal scutellars; sternopleurals 1–1. Hair black. Scutellum rusty reddish, the free border a little paler.

Legs reddish, the tarsi brown beyond the first segment; hair black.

Wings cinereous hyaline, a little darkened apically, the costal border broadly brownish from the apex of the auxilliary vein almost to the third vein and tinged with brown before the apex of the auxilliary vein. Squamæ strongly brown-tinged, pale basally. Halteres yellow.

Abdomen rusty reddish, with shining black fasciæ. First segment with the brown apical fascia rather narrowly interrupted in the middle; the black fasciæ on the second and third segments occupy the apical half in the middle and somewhat less laterally; the fourth segment is black on the apical third to one-half, the fascia broadly interrupted in the middle. Hair black.

TYPES.—Holotype, female, Reppo's Town, Liberia, September 1, 1926; paratype, female, Du River Camp No. 3, Liberia, 1926 (J. Bequaert).

This species is related to *bivittata* Curran but may be distinguished at once by the color of the hair on the suprasquamal declivities, this being all coarse and black in *confusa* but mostly long, fine and yellowish in *bivittata*. In addition the brown costal border is distinctly interrupted in *bivittata*, the front is yellow on the lower three-fourths, etc.

Tricyclea similis, new species

Related to *bifrons* Malloch from which it differs in having the costal border brown from a point a little beyond the humeral cross-vein. In *bifrons* there is no brown coloration before the auxilliary vein. Length, 6 to 6.25 mm.

MALE.—Head yellowish, the upper half of the front, and the occiput to the lower edge of the eyes, black. Eyes almost touching for nearly one-third their length; seven pairs of weak frontals restricted to the lowest third; ocellars weak; outer verticals absent. Posterior orbits gray pollinose. Cheeks shining, little more than one-fourth as wide as the eye-height, black-haired. Parafacials narrow, with a row of tiny black hairs above. Palpi yellowish, normal; proboscis shining reddish. Antennæ reddish yellow, the third segment faintly brown.

Thorax rusty yellow, the mesonotum black with the sides broadly pale, the pollen grayish brown, cinereous anteriorly and on the pleura; sternum brown, the pteropleura with a large brown spot; scutellum brown with the free border broadly yellowish. Hair black. Acrosticals 3–3; dorsocentrals 2–4; two sublaterals; one posthumeral, the outer one absent; three intra-alars, the bristle inside the pre-alar quite weak; four or five pairs of marginal scutellars; sternopleurals 1–1.

Legs reddish yellow, black-haired; tarsi brownish beyond the first segment.

Wings cinereous hyaline, the costal border brown from a little beyond the humeral cross-vein to the apex of the wing, distinctly interrupted just beyond the tip of the first vein. Squamæ pale brown, paler basally, the border brown. Halteres reddish yellow.

Abdomen rusty yellowish, with black fasciæ. First segment with the apex narrowly brown except in the middle and laterally. Second segment with the apical third black, the third with a somewhat wider black fascia; fourth segment with the apical third black except in the middle. Hair black.

FEMALE.—Front wide above, narrow on lower half, black on the upper half; seven pairs of decussate frontals, one pair of divergent and one pair of reclinate;

outer verticals as long as verticals; ocellars somewhat stronger than in male. The black abdominal fasciæ are all considerably wider, those on the second and third segments occupying more than the posterior half of the segments in the middle while the inner ends of the black spots on the fourth segment reach about half-way to the

Types.—Holotype, male, Lenga Town, Liberia, August 15, 1928; allotype, female, Reppo's Town, Liberia, September 1, 1926; paratype, female, Memeh Town, Liberia, August 22, 1926 (J. Bequaert).

Hemigymnochæta clara, new species

At once distinguished from all the species in the genus by the presence of only three pairs of postsutural dorsocentrals and the unicolorous wings. Superficially similar to *difficilis* Curran but *difficilis* has four postsutural dorsocentrals. Length, 5 to 7 mm.

Male.—Head yellow, whitish pollinose; upper half of the occiput black in ground color. Eyes almost touching for one-fourth the length of the front; six or seven pairs of frontals confined to the lowest third; ocellars moderately strong; outer verticals absent; frontal vitta mostly, and the ocellar triangle, rusty reddish or ferruginous, the triangle with brown pollen. Cheeks about one-fifth as wide as eye-height, wholly black-haired. Parafacials narrow, with scattered, tiny black hairs above. Facial ridges with two or three rows of short bristly hairs on the lowest third. Proboscis reddish; palpi yellow, normal. Antennæ reddish yellow, the arista mostly brown.

Thorax pale rusty reddish, the mesonotum of a darker shade, thinly cinereous white pollinose, the mesonotum and scutellum appearing wholly pollinose from posterior view. Acrosticals 3-3; dorsocentrals 2-3; two sublaterals; the inner posthumeral weak or absent, the outer absent, three intra-alars, the anterior one very weak; four pairs of marginal scutellars, the hairs on the under surface of the scutellum yellow; sternopleurals, 1-1. Hair black, mostly yellow on the posterior half of the pleura.

Legs yellowish, the tarsi somewhat darker apically. Hair and bristles black, the fine hair on the coxæ yellow.

Wings with slight luteous tinge or cinereous hyaline. Lower squamal lobe narrow, not produced inwardly, the squamæ pale luteous in color. Halteres yellow.

Abdomen pale rusty-yellowish, the apices of the segments very narrowly brownish. Third and fourth segments each with a row of marginals, the fourth with a row of discals. Hair black, except on the venter basally.

Female.—Front with almost parallel sides, the vitta dark rusty-reddish, the upper orbits ferruginous, the ocellar triangle brownish; parafrontals pale pollinose; six pairs of decussate frontals, one pair of divergent and one pair of reclinate; ocellars strong; outer verticals long; palpi slightly larger. Mesonotum distinctly vittate from either anterior or posterior view, the pollen so arranged as to show only from one view; from posterior view there appear to be five bare vittæ, which, from anterior view, appear pollinose. The brown abdominal fasciæ are much more noticeable and sometimes much wider.

Types.—Holotype, male, Manguendi, S. Rhodesia, February 22, 1917; allotype female, Que Que, S. Rhodesia, April 17, 1921 (J. D. W.). Paratypes: four females, Gatooma, S. Rhodesia, December, 1927 (A. Cuthbertson) and one female, Que

Que, April 12, 1921. Paratypes have been returned to the British Museum, Mr. Cuthbertson and Mr. Munro.

Hemigymnochæta apicifera, new species

Evidently related to *difficilis* Curran but distinguished from all the described species with unicolorous wings in having a pair of transverse, black apical spots on the fourth abdominal segment. Mesonotum wholly rusty reddish; abdomen with black fasciæ. Length, 5.5 to 6.5 mm.

MALE.—Head rusty yellowish, cinereous white pollinose, front on more than the upper half, and the occiput to the lower edge of the eyes, black in ground color. Eyes closely approximated for one-third the length of the front; five or six pairs of frontals limited to the lowest third; ocellars moderately strong; outer verticals slightly developed. Cheeks about one-fourth as wide as the eye-height, wholly black-haired. Parafacials very narrow, with only two or three inconspicuous black hairs below the frontals. Proboscis reddish; palpi yellow, normal in shape. Antennæ pale orange, the arista mostly black.

Thorax rusty reddish, the pleura paler, thinly whitish pollinose; hair black, mostly pale on the pteropleura. Acrosticals 3–3; dorsocentrals 2–4; sublaterals 2; posthumerals 2; intra-alars 3; five or six pairs of marginal scutellars; sternopleurals 1–1.

Legs reddish yellow, the tarsi pale brownish apically. Hair black; pulvilli small, grayish.

Wings with luteous tinge, a little darker in front. Squamæ luteous, convex on the inner side and with a slight lobe basally, but not produced to beneath the scutellum. Halteres yellow.

Abdomen rusty reddish or yellowish, black-haired, the first sternite with pale pile. First segment narrowly brown apically; second and third segments each with a black fascia posteriorly, the second with or without a narrow median brown vitta; fourth segment with an elongate oval black spot on either side. The band on the third segment is widest, occupying about the posterior fourth of the segment. Third and fourth segments each with a row of erect marginals, the fourth with a row of discals on the basal half.

FEMALE.—Front slightly narrowed on the anterior third, wholly black on the upper two-thirds or more, rarely entirely black, the parafrontals cinereous pollinose; eight pairs of frontals, the upper pair strong and reclinate and one pair of proclinate orbitals situated at the upper fifth of the front. Palpi slightly larger than in the male.

TYPES.—Holotype, male, Memeh Town, Liberia, August 29, 1926; allotype, female, Reppo's Town, Liberia, September 1, 1926. Paratypes: male, Memeh Town, August 29; male, Bakra Town, Liberia, October, 1926; five females, Reppo's Town, September 1, 1926 (J. Bequaert).

Hemigymnochæta liberia, new species

Related to *angola* Townsend but the fourth abdominal segment is entirely black apically instead of yellowish, and the squamæ are brown. Length, 6 mm.

FEMALE.—Head rusty reddish, cinereous-white pollinose, the upper half of the front and the occiput, above the lower level of the eyes, black in ground color. Front of moderate width, narrowing anteriorly; eight pairs of frontals, the upper pair reclinate and one pair of proclinate orbitals situated at the upper fifth; ocellars fairly strong; outer verticals as strong as verticals. Cheeks wholly black-haired. Parafacials very narrow, with a few short black hairs above. Facial ridges with very short bristly hairs on the lower third. Palpi and proboscis reddish, the former a little swollen. Antennæ reddish, the arista mostly brown.

Thorax rusty reddish, the mesonotum more or less ferruginous on the median third, thinly cinereous white pollinose, the mesonotum not vittate. Scutellum dark rusty reddish, the free border broadly paler. Acrosticals 3–3; dorsocentrals 2–4; sublaterals 2; posthumerals 2; intra-alars 3, the anterior one weak; four or five pairs of marginal scutellars. Hair black, largely pale on the posterior half of the pleura.

Legs reddish yellow, black-haired; tarsi becoming brownish apically.

Wings strongly tinged with yellowish brown. Squamæ light brown. Halteres yellow.

Abdomen shining black, the first segment, except the posterior border, and a large basal triangle on either side of the fourth segment, rusty reddish. Hair black, the venter with yellow hair basally. Only the fourth segment with a row of marginals; no discals.

HOLOTYPE.—Female, Du River Camp No. 3, Liberia, 1926 (J. Bequaert).

The abdomen is unusually black in the single specimen before me but does not appear to be stained. However, it seems likely that specimens will be found in which there are reddish bands or spots basally on the second and third segments.

Hemigymnochæta mitis, new species

Black and pale rusty-reddish; femora black; wings with the costal border brown. Length, 4.75 mm.

MALE.—Head rusty reddish, the occiput above the lower level of the eyes and the upper half of the front black in ground color; pollen cinereous. Eyes closely approximated for less than one-third the length of the front; five pairs of frontals restricted to the lowest third; ocellars of moderate length; outer verticals absent. Cheeks almost one-fourth as wide as eye-height, black-haired. Parafacials very narrow, with three or four tiny black hairs in a row on the upper part. Proboscis blackish; palpi reddish, slightly enlarged, black-haired. Antennæ reddish, the third segment broadly tinged with brown above.

Thorax black, with cinereous pollen, the propleura, broad lateral margins of the mesonotum, its posterior border and the broad free border of the scutellum rusty reddish. Acrosticals 3–3; dorsocentrals 2–4; sublaterals 2, posthumerals 2; intra-alars three; four or five pairs of marginal scutellars; sternopleurals 1–1. Hair black.

Legs blackish, the coxæ, trochanters, bases of the femora and their tips, anterior four tibiæ and the basal tarsal segments reddish or reddish yellow, base and apex of posterior tibiæ obscurely reddish. Hair black.

Wings cinereous hyaline, the costal border broadly brownish beyond the tip of the auxilliary vein, the brown color paler immediately beyond the apex of the first vein, but not clearly interrupted. Squamæ pale brown, evenly convex on the inner border but not conspicuously lobed. Halteres yellow.

Abdomen rusty reddish, each segment with a moderately broad shining black apical fascia, that on the fourth segment broadly interrupted in the middle. Hair black. Fourth segment without discals.

HOLOTYPE.—Male, Paiata, Liberia, October, 1926 (J. Bequaert).

This species is apparently related to *verticella* Villeneuve, but that species has only three postsutural dorsocentral bristles, and the femora are not black.

Hemigymnochæta bequaerti, new species

Rusty reddish, the abdomen with shining black fasciæ, costal border broadly brown beyond the apex of the first vein. Length, 7 to 8 mm.

MALE.—Head pale rusty-reddish, with cinereous pollen; upper half of the front, and the occiput above the lowest level of the eyes, black in ground color. Eyes closely approximated for one-third the length of the front; five or six pairs of frontals; ocellars rather weak; outer verticals absent. Cheeks hardly one-fourth as wide as eye-height, wholly black-haired. Parafacials very narrow, with several tiny black hairs above. Palpi and proboscis reddish yellow, the former not enlarged, black-haired. Antennæ reddish, the third segment broadly brownish above.

Thorax rusty reddish, with thin yellowish pollen above and whitish below. Hair black, mostly yellowish on the pleura. Acrosticals 3–3; dorsocentrals 2–4; sublaterals 2; posthumerals 2; intra-alars 3; five or six pairs of marginal scutellars; sternopleurals 1–1.

Legs reddish yellow, the tarsi mostly brownish red; hair black, partly yellow on the anterior tarsi.

Wings with strong luteous or cinereous tinge, broadly brown along the costal border beyond the apex of the first vein. Squamæ brownish, slightly lobed basally. Halteres yellow.

Abdomen rusty reddish or yellowish, with three black fasciæ. First segment narrowly brown on the apex, second with a narrow black apical fascia, the third and fourth with much broader apical fasciæ. In the type the fourth segment appears mostly black dorsally, but this is undoubtedly due to staining. Hair black, yellow on the basal sternites; fourth segment without discals.

TYPES.—Holotype, male, Paiata, Liberia, September, 1926; paratype, Du River Camp No. 3, Liberia, 1926 (J. Bequaert).

This species is readily distinguished from *mitis* Curran by the large size, reddish-yellow femora and entirely pale thorax.

RHINIA Desvoidy

DESVOIDY, 1830, Mem. Acad. Roy. Sci. Inst. France, (2) II, p. 422.

As a general rule all species of Rhiniinæ with the apical cell petiolate have been placed in this genus, but the character is not of generic importance, and its use separates obviously closely related species. The only character upon which it seems possible definitely to restrict *Rhinia* is to be found in the elongate, parallel-sided palpi, which are five or more times as long as wide. I have before me seven African species which fall into the genus *Rhinia* as here restricted, and they form a very homogeneous group. Should this character be found to be of no value the only recourse will be to bring all the species now placed in *Stomorhina* Rondani into the present genus. The synonymy of *Stomorhina* is discussed in the following pages.

Rhinia atra, new species

Black, the tibiæ reddish; pleura yellow pollinose on upper half; wings luteous, with black cloud on apical fourth; two mesopleural bristles. Length, 5.5 mm.

MALE.—Head shining black, the parafacials with a tiny triangle below and a larger one above, cinereous-yellow pollinose. Eyes closely approximated for more than one-third the length of the front; five pairs of frontals limited to the lower third; ocellars well developed; outer verticals absent; hair on the cheeks yellow. Palpi brown, with parallel sides, about five times as long as wide. Antennæ reddish brown. Antennal grooves very thinly grayish pollinose.

Thorax black; mesonotum and scutellum grayish-brown pollinose from posterior view, each hair arising from an opaque black spot, the spots tending to form longitudinal lines; no distinct vittæ. Pleura yellow pollinose and pilose on the upper half, shining below. Scutellum with pale yellowish ventral fringe.

Legs black; tibiæ and basal two segments of the posterior four tarsi reddish; anterior coxæ not pollinose, their hair wholly black.

Wings with strong luteous tinge, with a brown cloud on the apical fourth in front; apical cell moderately long petiolate. Squamæ brownish. Halteres yellow.

Abdomen shining brownish black, the middle of the venter obscurely cinereous pollinose. Hair black, yellow on the venter basally. Fourth segment with one or two weak discals toward either side.

TYPE.—Male, Reppo's Town, Liberia, September, 1926 (J. Bequaert).

This species may be distinguished from any thus far described by the wholly black cheeks. It is the only one I have seen possessing this character, and also none of the others have the abdomen wholly black. The palpi are similar in shape to those of *apicalis* Wiedemann. *R. simulatrix* Loew is similar to *apicalis* but has very much longer palpi.

STOMORHINA Rondani

RONDANI, 1861, 'Dipt. Ital. Prodr.,' IV, p. 9.
Stomatorhina of authors; *Idia* Meigen, preoccupied.
Idiella BRAUER AND BERGENSTAMM, 1893, Denkschr. Akad. Wien, LVI, p. 154.
Chlororhinia TOWNSEND, 1917, Rec. Ind. Mus., XIII, p. 191.

Malloch[1] limits the genus *Stomorhina* to species having more than two bristles on the mesopleura and distinguishes *Rhinia* Desvoidy and *Idiella* Brauer and Bergenstamm by the usually petiolate apical cell in the former and at most very short petiolate apical cell in the latter, as well as by what appear to be unimportant characters from a generic viewpoint. Inasmuch as typical species of *Rhinia* all have long, narrow palpi, while the others have the palpi broadened, that genus is readily separated. The number of mesopleural bristles varies and does not appear to be of sufficient importance to warrant its use as a generic character, and it does not seem possible definitely to recognize two genera on this character. *Chlororhinia* Townsend appears, upon study of the genotype, to be a valid genus, since it lacks the posthumeral bristle and looks quite different from the other species. However, in a species from Africa which is undoubtedly allied to *C. viridis* Townsend this bristle may be either present or absent. Since the characters are variable and there, at present, appears to be no real basis for the isolation of species into distinct genera, I feel that it is but logical to recognize *Rhinia* and *Stomorhina* as the only valid calliphorid genera having the arista haired on the upper side only.

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[1] Ann. Mag. Nat. Hist., XVIII, pp. 496-522, 1926.

I have before me several undescribed species belonging to this genus, descriptions of three of these being presented at the present time, the remainder being left until it is possible to secure notes on types of older species in order that characters not mentioned in the descriptions may be verified.

Stomorhina chapini, new species

A small black species with punctulate cinereous pollen on the thorax and abdomen, the scutellum bright yellow on the apical third and a short brown preapical fascia on the wing. Related to *Chlororhinia viridis* Townsend but distinguished by the color and in having the abdomen of the female slightly longer than wide. Length, 4.5 mm.

FEMALE.—Head shining black, with a small, cinereous-pollinose spot on each orbit opposite the base of the antennæ. Front wide, the subopaque frontal vitta scarcely as wide as either parafrontal; seven or eight pairs of rather short, decussate frontals, the upper pair, situated near the vertex, and two pairs of orbitals arising close to the line of the frontals, divergent and subappressed; ocellars as strong as the frontals; outer verticals as long as the verticals; parafrontals destitute of hair; occipital cilia black, short. Cheeks about two-fifths as wide as eye-height, with fairly long, sparse, fine cinereous yellow hair, the occiput with similar hair below. Parafacials rather narrow, with four low, transverse ridges. Palpi brown, about twice as as long as wide, obtuse apically. Vibrissæ situated well above the oral margin; two or three very small bristles above them; facial depression thinly cinereous pollinose on the upper half. Antennæ brown, reaching almost or quite to the vibrissæ; arista with moderately long rays above.

Thorax black, cinereous pollinose, each hair on the mesonotum and mesopleura arising from a round black spot; behind the suture, a broad, subshining black band extends almost the whole way across, the sides being pollinose, the scutellum shining black with the apical third bright yellow. Hair of the dorsum very short and black, on the pleura fine and yellow. The acrosticals and dorsocentrals are represented only by prescutellar bristles, while the only bristles in front of the suture are the presutural and sometimes the posthumeral. Fringe of sparse hairs on lower edge of scutellum yellowish. Mesopleura with five bristles posteriorly.

Legs black; posterior four tibiæ and the basal two or three segments of their tarsi reddish yellow, the anterior tarsi brown, sometimes reddish yellow dorsally. Hair and bristles black, the hair partly yellow on the anterior coxæ.

Wings cinereous hyaline, broadly yellowish basally; anterior cross-vein broadly clouded with pale brown; a broad brown fascia extends obliquely from the costa, arising before the end of the second vein, to the middle of the apical part of the apical cell. Third vein scarcely carried forward beyond the end of the long-petiolate apical cell. Squamæ cinereous white, pure white basally. Halteres yellow, the knob white.

Abdomen black, slightly shining, the second and third segments cinereous pollinose on a little more than the basal half of the lateral third or less, the venter much more extensively pollinose. Hair short and black, those on the pollinose areas arising from black spots. Fourth tergite with a median, transverse row of fine discals and with about four fine marginals. Abdomen a little longer than wide.

TYPES.—Holotype, female, and three paratypes, Lukolela, Congo, January 13, 1931 (J. P. Chapin).

Stomorhina apta, new species

Blackish, the apex of the scutellum and the venter in part, yellowish; mesonotum trivittate; mesopleura with four black bristles posteriorly Length, 7 to 8 mm.

FEMALE.—Head black, somewhat shining; occiput cinereous pollinose, the posterior part of the cheeks cinereous yellow and with yellow pile. Front wide, the dull frontal vitta a little more than twice as wide as either parafrontal; about nine pairs of frontals, the upper pair reclinate; three or four pairs of divergent orbitals arising close to the frontal row and two or three proclinate orbital hairs below them; ocellars and outer verticals strong; occipital cilia black. Frontal orbits with two spots of cinereous-yellow pollen, a rather obscure one at the upper fourth, above which there is thin brown pollen and a larger one at the lower third. The parafacials are wide and are ornamented with two pollinose spots, one lying near the upper end broad and extending to the facial ridges, the other at the lower end small and triangular. Palpi brown, increasing in width from the base to near the rounded apex, about three times as long as wide. Antennæ reddish brown, the basal segments shining.

Thorax black, the pleura wholly cinereous-yellow pollinose and with thin yellowish pile. Mesonotum rather thinly cinereous pollinose, with three dull blackish vittæ when seen from behind, each hair arising from a dull black spot, the hairs black, the spots tending to form irregular longitudinal rows. Scutellum mostly dull, the sides and the broadly yellow apex conspicuously pollinose, the sparse ventral fringe of hairs yellow. Mesopleura with four or five black bristles posteriorly.

Legs black, the tibiæ brown or brownish red, the basal two or three segments of the posterior four tarsi reddish; anterior coxæ yellow pollinose and with yellow hair, the apical half bearing black bristles.

Wings strongly tinged with brown on the anterior half, darker on the apical half in front, the posterior part cinereous hyaline, the base brown. Apical cell open. Squamæ white, brown on the inner third or less. Halteres reddish with yellow knob.

Abdomen black, the sides, apical segment and venter with cinereous pollen, the hairs arising from dark spots, black, the venter with yellowish hair basally. The abdomen may be wholly black or there may be large yellow areas on the venter.

In the type the under side of the first segment is yellow except posteriorly, and there are large transverse basal spots of a reddish color on the second and third segments which do not encroach on the dorsum; in one paratype the venter is yellow, the broad apices of the segments black, the yellow extending slightly on to the dorsum. The second paratype has the abdomen wholly black. Fourth segment without discal bristles.

TYPES.—Holotype, female, S. Masai Reserve, Kenya Colony, May 16, 1913 (J. T. Anderson). Paratypes: female, Uganda, 1911 (Dr. C. H. Marshall); female, Toro, Uganda, June, 1925 (G. L. P. Hancock). The first two specimens are in the British Museum, the last in The American Museum of Natural History.

This species has the facies of those considered as typical of *Idiella* Brauer and Bergenstamm, but on the character of the pleural bristles would be placed in *Stomorhina*, and the venation is typical of the latter. The brown wing-markings will distinguish *apta* from all the African species known to me, in which there are more than two mesopleural bristles. Possibly its nearest relative is the Australian *subapicalis* Macquart which has, however, greenish or bronzed thorax and cinereous-hyaline wings with much less conspicuous brown markings apically.

Stomorhina mitis, new species

Related to *tricincta* Bigot from which it it distinguished by the black spots on the pleura being larger, many of them confluent, at least half of the mesopleura shining and the mesonotum much less distinctly vittate, and the abdomen is black in ground color. Length, 5 to 6 mm.

MALE.—Head black in ground color, with cinereous-white pollen, the non-pollinose spots shining; the pollen covers the upper half of the parafacials, the frontal orbits, posterior orbits and more than the posterior half of the cheeks, and there is a minute triangle at the lower end of the parafacials. On the parafacials there are one or two black spots in the pollinose area while on the front and cheeks each hair arises from a large shining black spot; hair on the cheeks yellow, elsewhere black. Front very narrow on the upper half; five or six pairs of frontals restricted to the lower half; ocellars short; outer verticals absent. Parafacials moderately wide. Palpi brown, broad, about three times as long as wide. Facial depression pollinose on the upper three-fifths. Antennæ reddish brown; arista luteous basally.

Thorax black or greenish black, thickly pollinose, the sternopleura and lower part of the mesopleura behind and lower third or more of the pteropleura bare in well-preserved specimens; pleural hair yellow, that on the dorsum brown or black; two mesopleural bristles. The hairs on the mesonotum each arise from an oval shining black spot, the spots tending to form longitudinal lines, while in some lights there are three distinct, dark vittæ. In general the mesonotum appears only thinly grayish pollinose and weakly dark vittate and has a greenish tinge. The pollen on the mesopleura is studded with large black spots which tend to fuse, so that their area, together with the normally bare part, comprises more than half of the mesopleura. Scutellum with similar pollen, the dorsum with a large bare spot on the apical half or less. Ventral fringe yellow.

Legs black, the middle tibiæ reddish brown, the basal one or two segments of the posterior four tarsi reddish. Anterior coxæ with yellowish hair and cinereous pollen, the bristles confined to the apical half.

Wings cinereous hyaline, with a large preapical brownish triangle and the costal cell brown at the base. Apical cell short petiolate. Squamæ brown, the base of the lower and almost the whole of the upper lobe white. Halteres yellow.

Abdomen black, the dorsum with three pairs of large, transverse, cinereous-white pollinose spots which are broadly separated in the middle and united laterally to the pollen of the venter; the bands are more broadly separated from the posterior borders of the segments than from the anterior, their inner ends rounded; toward the outer ends the shining black punctures are large, but they become minute or absent toward the inner ends. On the venter the shining spots are large and form irregular lines or even fuse posteriorly on the posterior parts of the segments. Hair black, pale on the basal half of the venter. Under side of first segment brown; basal three sternites, and edges of the adjacent tergites, bordered with yellow. Genitalia brown. Fourth segment without discals.

FEMALE.—Front wide, gently narrowing above, the pollen on each parafrontal with two rows of large, transverse shining black spots, those in each row sometimes tending to unite with those in the other row and to a much less extent with spots in the same row; frontal vitta of equal width throughout, at the middle scarcely as wide as either parafrontal opposite. There are about ten pairs of frontals (arising from black spots), the upper pair reclinate, and five or six pairs of divergent orbitals. Outer verticals strong; cheeks white-haired. Ventral scutellar hair rather abundant, whitish, the pleural hair white or yellowish tinged; sternopleura with large black spots in the thick pollen.

TYPES.—Holotype, male, New Hanover, Natal, December 16, 1916 (C. B. Hardenberg); allotype, female, Barberton, Transvaal, May 5, 1913 (H. K. Munro). Paratypes: three males and one female, New Hanover, December 14, 1913 and February 16, 1914, (C. B. Hardenberg); five females, Barberton, May 5, 1913, May 17, 1913 and July 15, 1920 (H. K. Munro); female, Barberton, August, 1913 (L. S. H.); three males and two females, Estcourt, Natal, January 18, 1913 (R. C. Wroughton); male, Bloemfontein, Orange River Province, April 7, 1916; female, Yaba, Nigeria, July 25, 1909 (Dr. W. M. Graham); female, Mulata Mts., Harrar Province, Abyssinia, October 22–25, 1920 (B. Brown). Paratypes were returned to Mr. Munro and the British Museum of Natural History.

Rhynchomya nigeria, new species

Eyes bare; head yellowish; thorax yellowish pilose; abdomen reddish yellow, with black vitta and lateral margins; legs reddish. Related to *crinicauda* Villeneuve, but lacking the thick black hair on the under surface of the abdomen apically. Length, 10 to 10.5 mm.

MALE.—Head reddish or reddish yellow, cinereous-white pollinose, the occiput mostly black in ground color, the parafacials with thin silvery-white pollen. Eyes separated by a distance equal to the width of the ocellar triangle; front narrow on the upper fourth, the sides strongly diverging below, the face very much wider below than above; about twelve pairs of fine frontals, the hair fine and fairly abundant; ocellars well developed; outer verticals absent; occipital cilia black, fine. Pile of occiput and cheeks yellowish white, on the cheeks limited to the posterior third, the cheeks shining except behind and bearing very short, inconspicuous yellow hairs, their width equal to half the eye-height. Parafacials wide, the frontal hair continued to their lowest fourth; below with a very large, shining bare spot which cuts off a small orbital white triangle at the lower end. Palpi and proboscis rusty reddish. Antennæ orange, reaching to slightly below the middle of the face; arista bare. Facial carina flat, moderately wide.

Thorax metallic green, densely clothed with yellowish pile, that on the pleura almost white; the mesonotum moderately cinereous pollinose. Acrosticals 0–2; dorsocentrals 2–4 or 5; two sublaterals; one posthumeral; three intra-alars; three pairs of strong marginal scutellars and one or two weak pairs; sternopleurals 1–1. Scutellum reddish in ground color, the base and sides with green reflections.

Legs reddish; coxæ white-haired, the anterior pair bearing several black bristles on the apical half; anterior femora white-haired behind, the posterior four with pale pile posteriorly on the basal half or less. Tarsi brown, the posterior four with the basal two or three segments reddish with dark apices. Middle tibiæ with ventral bristle.

Wings cinereous hyaline, the veins yellowish basally. Squamæ white, or with yellow tinge, the lower lobe produced inwardly. Halteres reddish yellow.

Abdomen rusty yellowish, the apex rusty reddish; a broad median black vitta extends from the base of the abdomen to the base of the fourth segment; sides of the first to third segments each with a large blackish spot on the posterior half, the spots with more or less green reflection, the median vitta partly thinly cinereous pollinose. Hair black, the venter almost entirely pale yellow-haired. No discal bristles, the few marginals fine.

TYPES.—Holotype, male, Ibadan, Nigeria, August 8, 1925 (F. D. Golding), in British Museum of Natural History. Paratype, male, Ideasi, N. Nigeria, June 30, 1912 (Dr. J. W. Scott-Macfie).

In some respects this species resembles *tetropsis* Bigot but has much shorter antennæ and narrower palpi. The eyes bear very short, sparse hairs. Apparently this is a sexual character in this genus. According to Malloch this species would fall within the genus *Beria* Desvoidy, but the characters used for the separation of the two genera are variable. It is probable that the name *Beria* will have to be used for this genus, but until *Beria inflata* Desvoidy has been correctly identified it will be impossible to decide. I believe I have the species from South Africa, and if such is the case the characters given by Malloch for *Beria* are erroneous in so far as chætotaxy is concerned. However, there are two South African species which agree well with Desvoidy's description, so the matter remains complicated. Previous identifications of *inflata* are evidently erroneous.

Rhynchomya pollinosa, new species

Related to *disclusa* Villeneuve but distinguished by the concolorous thorax and abdomen, the latter being much more thickly pollinose than in *disclusa*. Length, 9 to 10.5 mm.

MALE.—Head reddish, cinereous pollinose; parafrontals and occiput above the lower level of the eyes black, the occiput also reddish below the vertex. Eyes separated by a distance equal to that across the posterior ocelli, the front widening on the anterior two-thirds; about ten pairs of frontals, the upper ones hair-like, and a secondary row of four or five bristles or bristly hairs outside the lower ones; parafrontal hair coarse, sparse. Ocellars strong; outer verticals absent. Cheeks more than one-third as wide as eye-height, black-haired, the hair sparse, sometimes partly yellow on the lower part; a more or less distinct, and variable in size, bare spot on the upper anterior portion, otherwise thinly pollinose. Parafacials wide, with sparse black hair, pollinose except for a bare, brownish-red spot below which varies in size and may be almost obsolete. Palpi and antennæ reddish, the latter reaching little more than half-way to the oral margin; arista bare. Facial carina moderately sharp, obsolete on lower half.

Thorax bronzed, thickly ashy pollinose without vittæ, the bronze color showing through in some lights, from posterior view most of the mesonotal hairs appear to arise from black spots. Pleural hair pale yellowish, that on the mesopleura and dorsum black. Acrosticals 1 to 3–4 to 7; dorsocentrals 2 or 3–4; two sublaterals; outer posthumeral absent; three intra-alars; three pairs of marginal scutellars; sternopleurals 1–1.

Legs black; tibiæ reddish, the basal segment of the posterior four tarsi brownish red. Hair black; coxæ, and the femora in some views, cinereous pollinose.

Wings cinereous hyaline, yellowish basally. Squamæ narrow, whitish or with luteous or cinereous tinge. Halteres yellow.

Abdomen bronze-colored, thickly cinereous pollinose, the hairs in some lights appearing to arise from dark spots, the pollen with just a slight tessellation with light incidence. Fourth segment with a row of discals which are not, however, conspicuous and are usually situated beyond the middle of the segment, and in addition there are sometimes additional ones either behind these or in front of them, the intermediate segments with median lateral bristles. Hair wholly black. Genitalia small, blackish, thinly pollinose.

FEMALE.—Occiput black as in the male. Front very wide and swollen, convex, the parafrontals at their middle each about three times as wide as the frontal vitta, reddish in ground color, clothed with cinereous-yellow pollen which leaves a bare spot at the base of each hair and bristle. The frontals number about twelve pairs, the upper pair reclinate, while there is a secondary row of about ten, but the bristles are irregular and inclined to be scattered. Outside the decussate bristles are a variable number of proclinate or divergent ones, some of which are strong while others are not well differentiated from the hairs. The hair is mostly coarse and of variable length. Parafacials with coarse hair as on the front.

TYPES.—Holotype, male and allotype, female, Pretoria, Transvaal, September 21, 1915. Paratypes: male and one female, Pretoria, September 29, 1914 (H. K. Munro); female, Pretoria, September 25, 1912 (C. B. Hardenberg). The types have been returned to Mr. Munro.

Eurhynchomyia thoracica, new species

Eurhynchomyia obtusa MALLOCH, 1926 (not *Xysta obtusa* Bigot), Ann. Mag. Nat. Hist., XVIII, p. 513.

TYPES.—Two specimens of each sex from Port Shepstone, Natal, August 7, 15, 28, 1920 (H. K. Munro); four females, Illovo, S. Africa, June 8, 22, 1919 (W. H.); one female, Durban, Natal, September 6, 1921. The holotype, male and allotype, female, have been returned to Mr. Munro.

This species has been characterized by Malloch in the reference cited above. The two sexes are very similar in coloration and differ very materially from the description of *Xysta obtusa,* which is undoubtedly a true *Rhynchomya* related to *tetropsis* Bigot, *discrepans* Villeneuve, etc.

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GENOTYPE DESIGNATIONS OF THE GENERA *HYDROPHILUS* AND *HYDROCHARA*

BY ANDREW J. MUTCHLER

In an attempt to confirm the determinations of certain species of Hydrophilidæ from Porto Rico and the Virgin Islands, I referred to 'Coleopterorum Catalogus,' part 79, published in 1924, in which A. Knisch lists (p. 236) *Hydrophilus* Leach, type *caraboides* Linnæus, and *Hydrous* Leach (p. 242), type *piceus* Linnæus

This classification does not agree with that of Leconte and Horn, nor with the usage of most American and many European authors. I therefore consulted the literature in order to find out to what authority Leach referred the above genera Doctor W. Dwight Pierce happened to visit the Museum while this research was in progress, and he suggested P. A. Latreille's (1810) 'Considerations Generales sur L'ordre Naturel des Animaux' as a possible source. This publication, not referred to in Knisch's work, afforded (page 190, "Genus 119") a brief diagnosis of the genus *Hydrophilus*, and on page 428 of "Table des Generes avec l'Indication de l'Espece" I found a fourth and last species under the caption: "FAMILLE XIV HYDROPHILIENS" "Hydrophile, *Hydrophilus piceus*, Fab." This species was originally described by Linnæus, and there is no doubt that Latreille referred to *piceus* Linnæus, since it was customary at that time to cite Fabricius as author for Linnæan species. A reference to the works of Fabricius will show that he quotes both Linnæus and Geoffroy among his citations.

As the above work of P. A. Latreille was published five years prior to that of Leach, 1815, 'Edinburgh Encyclopedia,' IX, p. 96, I am of the opinion that *piceus* Linnæus and not *caraboides* Linnæus is thereby made the type of *Hydrophilus*. This is also supported by the opinion of the International Commission of Zoölogical Nomenclature, which, although the vote on it was not unanimous, I believe worthy of serious consideration: "Opinion 11, The Designation of Genotypes by Latreille, 1810." The following is a copy in part:

> The Secretary has examined Latreille (1810) in search of evidence in support of the contention which Miss Rathbun states has been advanced, but he has failed to

find it. On the contrary he finds that Latreille distinctly says "avec l'indication de L'espèce," and not avec l'indication d'*une* espèce.

If all earlier authors had done as Latreille has here done, there would be very little confusion in nomenclature to-day, and from the evidence submitted no reason is apparent why Latreille's type designations should not stand as such.

It is self-understood that this opinion does not imply that Latreille's (1810) designations should take precedence over any earlier writings.

Opinion written by Stiles.

Opinion concurred in by 12 Commissioners: Blanchard, Dautzenberg, Graff, Jentink, Jordan, Joubin, Maehrenthal, Monticelli, Schulze, Stejneger, Stiles, Wright.

Opinion dissented from by 1 Commissioner: Hoyle who says: "I think that the evidence adduced by Stebbing (1898) from Latreille's writings shows that he did not use the word 'type' in the sense now attributed to it in zoological nomenclature. It was with him synonymous with 'example.'"

Not voting 2: Osborn, Studer.

In view of the above facts I feel satisfied that the type of *Hydrophilus* was clearly designated as *piceus* Linnæus by Latreille (1810). I also believe that Geoffroy should be given credit as author of the genus, for the following reasons: In 'Historie abregée des Insectes aux Environs de Paris,' 1762, I. pp. 180–184, Geoffroy erects the genus *Hydrophilus*, including the Linnæan species *piceus*, *caraboides*, and *fuscipes*, and describes two other forms, one of which is a nomenclatorially invalid polynomid and the other, *H. fulvus*, one of the few binomials (possibly accidental and subject to rejection) appearing in this work.

Unfortunately, Geoffroy, as was the case with many of the earlier authors, failed to designate a type for his genus. Therefore, it was left for some later author to make such a designation and this seems to have been clearly done by Latreille in 1810.

If we take into consideration the use of the name *Hydrophilus*, from the time it was referred to as a genus to the time Latreille designated the genotype, we shall find the following: *Hydrophilus* Geoffroy, 1762 and 1764, 'Hist. des Ins. envir. de Paris,' I, pp. 180–184, Pl. III, fig. 1 (figure of *piceus*); O. Müller, 1764, 'Fauna Insectorum Fridrichsdalina,' p. xvi (a copy ? of Geoffroy's diagnosis); Linnæus, 1767, 'Syst. Nat.,' 12th Ed., pp. 664–667 (*Hydrophilus* Geoffroy cited under *Dytiscus*); DeGeer, 1774, 'Mem. Ins.,' IV, pp. 365–381, Pl. XIV, figs. 1–11 (gives a detailed description of *Hydrophilus*. In his description of the genus, DeGeer refers to the drawings of *H. piceus* which are in detail and which show the component parts of the insect); Fabricius, 1775, 'Syst. Ent.,' pp. 228–279 (includes nine species under the generic heading); Geoffroy, 1799, 'Historie des Ins.,' pp. 180–184, Pl. III, fig. 1 (a second edition of his 1762 work); Fabricius, 1801, 'Syst. Eleuth.,' I, pp. 249–255 (includes thirty species under the generic heading); P. A. Latreille, 1810, 'Consid. Gen.,' pp. 190 and 428 (on p. 190 a brief diagnosis of the genus is given, and on p. 428 the type of the genus is designated as *piceus*).

The treatment of *Hydrophilus* conflicts with *Hydrous*, for Leach (1815) lists the latter as follows: "*Hydrous* Leach from the Linnæan MSS. *Hydrophilus* Marsh. Latr. Fabr. sp. 1 *Piceus*, *Hydrophilus piceus* Fabricius, Marsham." If we consider the above designation of *piceus* as the genotype of *Hydrous*, this generic name must be placed in synonymy, and the next available name should be used for the genus. In this connection I have consulted the literature and find that *Hydrochara* Berthold, 1827, is the earliest valid name. In his work entitled 'Latreille's Naturliche des Thierreichs,' Berthold forms a table for the separation of the then-known genera of Hydrophilidæ, and (on p. 355) in the first part of the table he includes the genera *Spercheus*, *Hydrophilus* (*Hydrous* Leach), and *Hydrochara* (*Hydrophilus* Leach). A transcript of this paper appears in Thon, 1827–1829, 'Entomologisches Archiv.' The genus *Hydrochara*, which is erected by Berthold in the above publication, is based on M. Latreille's *Hydrochare*.[1] It is, therefore, my opinion that *Hydrochara* Berthold should replace *Hydrophilus* Leach, not of DeGeer and *Hydrous* of authors.

If the argument thus presented should prevail it will be necessary to change the citations in Leng's 'Cat. Coleop. of America North of Mexico,' p. 84, to read as follows: *Hydrophilus*, 2789 *triangularis* (Say), .90 *ater* (Oliv.), .91 *insularis* (Cast.); *Hydrochara*, 2793 *castus* (Say), .94 *richseckeri* (Horn), .95 *obtusatus* (Say), .96 *lineatus* (Lec.). It will also be necessary to change Bradley's key in 'A Manual of the Genera of Beetles of America North of Mexico,' 1930, p. 54, lines 5 and 10 to read: *Hydrophilus*, instead of "*Hydrous*," and *Hydrochara*, instead of "*Hydrophilus*."

In conclusion, I should like to call attention to the fact that if we ignore the 1762 edition of Geoffroy, as has been done by some authors, it will be necessary to change either the names of several of our well-known coleopterous genera or give credit to some later author for the erection of these genera.

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[1] See M. Latreille, 1825, 'Familles du Regne Animal,' p. 366.

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RHEOCLOIDES, A NEW ATHERINID FISH FROM MADAGASCAR

By J. T. Nichols and F. R. LaMonte

Through the kindness of Mr. Richard Archbold, a member of the expedition, we are in receipt of a small collection of fresh-water fishes obtained from the island of Madagascar by the Mission Zoologique Franco-Anglo-Américaine à Madagascar, Monsieur J. Delacour, Director. The most notable of these is an undescribed atherinid from the north-eastern part of the island.

Rheocloides, new genus

Anal fin of moderate length, originating under the first dorsal. First dorsal of about 5 weak, flexible spines, separated from the second by a distance slightly greater than the length of its longest ray. Caudal fin forked. Pectorals placed rather high, triangular. Origin of ventrals under last quarter of pectoral. Jaws about equal or the lower slightly projecting; maxillary extending to below front of eye. Jaws with bands of unequal pointed teeth, large for the family. Opercles and top of the head with large scales, but a scaleless area extends on the back to a little before the dorsal, downward in front of the pectoral and backward on the lower surfaces to the anal. Scales cycloid. Body robust; suggesting *Rheocles* in appearance, but differing from same in the various characters given above.

Type.—*Rheocloides pellegrini*, new species.

Rheocloides pellegrini, new species

Description of Type.—No. 9696, American Museum of Natural History, from "one day west" of Andapa, Madagascar, August 27, 1930, A. L. Rand and P. A. Du Mont.

Length to base of caudal, 68 mm.; depth in this length, 4.5; head, 3.7. Eye in head, 3.4; snout, 3.4; interorbital, 3; maxillary, 2.6; greatest width of body (back of head), 1.8; depth of peduncle, 2.9; its length, 1.6; longest dorsal spine, 3.8; longest dorsal ray, 2.5; longest anal ray, 2.5; caudal lobe, 1.3.

Dorsal, V–13; anal, 17. Scales 36, 12 around peduncle. Six rather short gill-rakers on the lower limb of the first arch.

Interorbital flat; lower jaw slightly projecting; maxillary normal, without a notch, slightly oblique, extending to under front of eye. Body robust, more compressed posteriorly. Ventrals extending to vent which is situated immediately before the anal origin. Top of the head and opercles with large scales; a scaleless area on the back extends to within about the length of its base from the first dorsal, downward before the pectorals, and back on the lower surfaces to the front of the anal.

Color pale, a dark streak in the center of the side posteriorly. A dark blotch across the base of the pectoral; pectorals and ventrals pale, other fins more or less dusky.

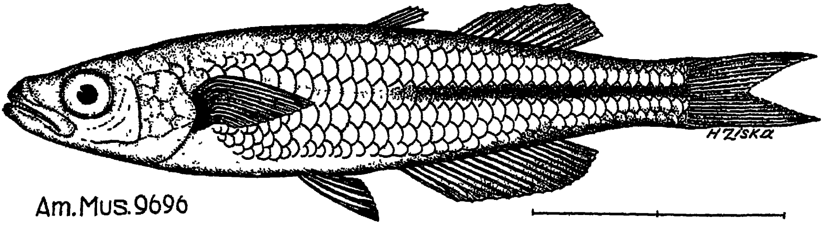

Fig. 1. *Rheocloides pellegrini*, type.

Comparative measurements of three other specimens with the same data follow:

Length	Depth	Head	Eye	Dorsal	Anal	Scales
45 mm.	4.8	3.5	3.2	IV–13	16	35
52	4.4	3.6	3.4	V–13	17	33
69	4.2	3.6	3.6	V–13	17	35

The scaleless area on the anterior part of the body is apparently not fortuitous, being similar in all four specimens, except that in the largest cotype it does not extend backward so far.

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STUDIES OF PERUVIAN BIRDS. II

PERUVIAN FORMS OF THE GENERA *MICROBATES*, *RAMPHOCAENUS*, *SCLATERIA*, *PYRIGLENA*, *PITHYS*, *DRYMOPHILA*, AND *LIOSCELES*

By John T. Zimmer

Microbates cinereiventris peruvianus Chapman

Microbates cinereiventris peruvianus Chapman, 1923 (August 28), Amer. Mus. Novit., No. 86, p. 5—La Pampa, southeastern Perú; ♂; Amer. Mus. Nat. Hist.

The type and two paratypes from the same general region appear to be the only Peruvian specimens known of this interesting bird. There are at hand five specimens from eastern Ecuador which apparently belong to the same subspecies, although they show some approach toward typical *cinereiventris* by being very slightly darker and duller on the back and head and with the center of the belly whiter. The difference is not great, and it is a question whether it deserves recognition by a separate name, although the known ranges in Ecuador and Perú are widely separated.

Specimens Examined

M. c. cinereiventris.—Colombia: Barbacoas, 1 ♂, 1(?); Alto Bonito, 1 ♀; Buenaventura, 1 ♀; San José, Cauca, 1 ♀ (?); Nóvita, 1 ♂; Juntas de Tamaná, 1 ♂. Ecuador: Chimbo, 2 ♀; Naranjo, 1 ♀, 2(?); Pato de Pauaro, 1 ♀; Río de Oro, 1 ♀ (?); Manaví, 1 ♀; Alamor, 1 ♂; Esmeraldas, 1 ♂.

M. c. magdalenae.—Colombia: Antioquia, 1 ♂ (type).

M. c. semitorquatus.—Panamá: 1 ♂ (type). Nicaragua: Los Sabalos, 1 ♂.

M. c. peruvianus.—Perú: La Pampa, 2 ♂ (incl. type); Río Tavara, 1 ♂. Ecuador: Río Suno, above Avila, 1 ♂; below San José, 2 ♀; mouth of Río Curaray, 2 ♀.

Ramphocaenus melanurus amazonum Hellmayr

Rhamphocaenus melanurus amazonum Hellmayr, 1907, Novit. Zool., XIV, p. 66—Teffé, Rio Solimoës, NW. Brazil; Tring Mus.

A male and a female from Lagarto, upper Río Ucayali (right bank), are perfectly comparable to two males from the type locality and a male and two females from the right bank of the lower Rio Madeira, Brazil. Four skins from the left bank of the Ucayali are, however, quite readily separable and are described below as new.

Nineteen specimens from the lower Tapajoz (both banks) show a distinct approach toward typical *melanurus* though they remain closer to *amazonum*. This approach is shown by the top and sides of the head being somewhat brighter than the back, which also is perhaps a little paler than in more western examples. Several of the skins have a more pronounced tendency toward ochraceous on the sides and flanks though not as pronounced as in *melanurus*. The wing and tail appear to average smaller though there is not much difference. None of the differences appear to be constant enough to warrant a separate name for the Tapajoz birds, especially since the characters are of an intermediate nature.

There is no reason to recognize two species of this genus. There is an excellent gradation of each of the characters by which *rufiventris* is supposed to be specifically separable from *melanurus*, though not always in the same order of arrangement of the subspecies, and the differences are all of degree. Since the various forms replace each other geographically, I prefer to refer them all to the single species *melanurus*.

Ramphocaenus melanurus obscurus, new subspecies

Type from Santa Rosa, upper Ucayali (left bank), eastern Perú. No. 240,690, American Museum of Natural History. Adult male collected November 21, 1927, by Carlos Olalla and sons.

Diagnosis.—Nearest to *R. m. amazonum* but darker above and with the breast, flanks, and the sides of the head more strongly ochraceous; tail shorter, with outer three pairs of rectrices with clear white terminal spots much as in *R. m. sticturus* which, however, is much paler in general coloration.

Range.—Western banks of the upper Río Ucayali in eastern Perú.

Description of Type.—Top of head and upper mantle dark Saccardo's Umber[1]; middle back darker, Olive Brown; rump still darker; upper tail-coverts somewhat brighter, like the upper back. Sides of head dull Buffy Brown with some traces of paler specks on the auriculars; an obsolete, narrow superciliary line from nostrils to over the auriculars; sides of neck somewhat clearer and brighter than the top of the head. Chin and throat white; breast dull, pale ochraceous-buff, darker on the sides, and with some traces of whitish subterminal spots; flanks broadly buffy like breast; middle of belly narrowly somewhat whitish; under tail-coverts like flanks. Wings fuscous, remiges and upper coverts externally margined with Saccardo's Umber x Cinnamon-Brown; bend of wing, under wing-coverts, and inner margins of remiges white; tail largely black; outer margins of rectrices basally Sepia; outer three rectrices with broad, clear white tips, broadest on outermost pair where there is a dusky or brownish spot at the tip of the outer web. Wing, 55.5 mm.; tail, 42; exposed culmen, 23.5; culmen from base, 28.5; tarsus, 22.5.

Remarks.—The single female has the breast and flanks a little paler than the type but darker than in *amazonum*. One of the male paratypes is a little darker than the type.

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[1] Name of colors when capitalised indicate direct comparison with Ridgway's 'Color Standards, and nomenclature.'

It is quite unusual to find the upper Ucayali acting as a distributional barrier, but it seems to be effective in the present instance. Further details regarding the distribution of both forms in Perú is highly desirable. There are no records of any sort from the lower Ucayali and yet the species is said to reappear in northern central Perú on the lower Huallaga and a nearby (more western) affluent of the Marañón, the Río Sillay, at Chyavitas. These northern records have been assigned to *amazonum*, but I am inclined to doubt the correctness of this assignment. A single breeding male specimen from the mouth of Lagarto Cocha, Río Napo, Ecuador, differs decidedly from three skins of *trinitatis* from farther up the Napo (lower Río Suno and mouth of the Curaray) and much more nearly resembles *amazonum* except that it is brighter and clearer (more rufescent) brown on the upper parts and the sides of the neck, and has the auriculars a little more deeply and extensively ochraceous, though much less so than in *trinitatis;* the under parts have very little ochraceous on the sides and breast, and the bill is distinctly broader than in either *amazonum* or *trinitatis*. Unfortunately this specimen lacks a tail. Taczanowski ('Orn. Pérou,' II, p. 53, 1884) describes a female from Yurimaguas as having the tail entirely black and the upper parts less rufous than in a French Guianan skin of *albiventris*, while the under parts are lightly washed with buff on breast and flanks. Hellmayr (Novit. Zool., XIV, p. 66, 1907) says of three skins from Yurimaguas, Chyavitas, and Santa Cruz, northern Perú, that they are rather brighter and clearer brown above than the type of *amazonum*. There is a strong probability that the Lagarto Cocha specimen either represents an undescribed form to which the north-Peruvian specimens belong or perhaps that it is an approach toward such a form from northern Perú. In any case, without more material, it is unsafe to carry the speculation farther. While most of the measurements of *obscurus* average a trifle larger than those of *amazonum*, the length of the tail appears to be distinctly greater in *amazonum*. In the three males of *obscurus* the tail is 42–42.5 mm. (average, 42.2); in *amazonum*, 46.5–50.5 mm. (average, 48.11). In the single female of *obscurus* the tail is 42.5 mm.; in the females of *amazonum*, 44–48.5 (average, 46.21).

SPECIMENS EXAMINED

R. m. melanurus.—BRAZIL: "Bahia," 3(?); Baião, Rio Tocantins (right bank), 1♂; Ananindeua, 1♂; Pernambuco, Palmares, 1♀; "Brazilia" (type of *Thryothorus gladiator*), 1.

R. m. albiventris.—BRITISH GUIANA: Tumatumari, 1♂. BRAZIL: Faro, 2♀.

R. m. sticturus.—BRAZIL: Primavera, Matto Grosso, 1♀; Barão Melgaço, 1♂; "Matto Grosso" (Natterer), 1♀.

R. m. amazonum.—BRAZIL: Boca Lago, Teffé, 2 ♂; Igarapé Auará, Rio Madeira, 1 ♂, 1 ♀; Borba, 1 ♀; Cametá, Tocantins (left bank), 1(?); Igarapé Bravo, Rio Tapajoz (left bank), 5 ♂, 5 ♀; Aramanáy, Rio Tapajoz (right bank), 1 ♂, 2(?); Tauarý (right bank), 2 ♂, 4 ♀. PERÚ: Lagarto, upper Ucayali (right bank), 1 ♂, 1 ♀.

R. m. obscurus.—PERÚ: Santa Rosa, upper Ucayali (left bank), 3 ♂ (incl. type), 1 ♀.

R. m. subspecies?—ECUADOR: mouth of Lagarto Cocha, Río Napo, 1 ♂.

R. m. trinitatis.—ECUADOR: mouth of Río Curaray, 1 ♀; lower Río Suno, 1 ♂, 1 ♀. COLOMBIA: Buena Vista, 1 ♀. VENEZUELA: Esmeralda, Mt. Duida, 4 ♂, 3 ♀; Playa del Río Base, 4 ♂, 2 ♀; Caño León, 1 ♂, 4 ♀; La Laja, Río Orinoco, 1 ♂; El Merey, Río Cassiquiare, 1 ♂, 1 ♀; opposite El Merey, 1 ♂, 1 ♀. Suapuré, 4 ♂, 2 ♀; San Antonio, 1 ♂ (very close to *pallidus*), 1 ♀; Cumanacoa, 1 ♂; Cristóbal Colón, 1 ♂, 1 ♀; Cocallar, 1 ♂; Cuchivano, 1(?). TRINIDAD: Pointe Gourde, 1 ♀; Caura, 1 ♀; Caparo, 2 ♀; Princestown, 1 ♂, 2 ♀; Carenage, Industry River, 2 ♂.

R. m. sanctae-marthae.—COLOMBIA: Santa Marta, Bonda, 2 ♂, 5(?); Concha, 1(?).

R. m. griseodorsalis.—COLOMBIA: east of Palmira, 1 ♂ (type); Dabeiba, Río Sucio, 1 ♂; El Roble, 1 ♂.

R. m. rufiventris.—NICARAGUA: 8 ♂, 7 ♀. GUATEMALA: 2(?). COSTA RICA: 2 ♀. PANAMÁ: 4 ♂, 3 ♀. ECUADOR: Portovelo, 2 ♂; Bucay, 1 ♂; Esmeraldas, 1 ♂; Alamor, 1 ♀ (?); Naranjo, 1 ♀ (?).

Sclateria naevia argentata (Des Murs)

Herpsilochmus argentatus DES MURS in Castelnau, 1856 (June), 'Expéd. Amér. Sud.,' (pt. 7), I, (3), livr. 18, p. 53, Pl. XVII, fig. 2—Nauta, northeastern Perú; Paris Mus.

Eleven specimens from eastern Perú, coming from localities ranging from the north bank of the Amazon at the mouth of the Napo to the upper Río Ucayali, and the Carabaya district of southeastern Perú, furnish good evidence as to the comparative uniformity of this subspecies in its Peruvian range. Birds from farther up the Napo, in Ecuador, at the mouth of the Curaray, are likewise typical. As the range approaches that of adjacent forms, however, there is a well-marked variation in the direction of these forms.

Thus on the left bank of the Rio Madeira, at Rosarinho, the males have quite distinct traces of dusky tips on the sides of the throat and of dusky lunules on the sides of the breast and flanks, while the feet are slightly duller in color and less brightly yellowish (in dried skins). The bill, wing, and tail also tend to be slightly longer. The females from this locality are a little paler tawny ochraceous on the lateral under parts, with faint suggestions of paler centers and darker lunules on those parts, while the upper parts average much lighter brown, less fuscous; the feet are like those of the male. These variations show a decided approach toward *S. n. toddi* of the Rio Tapajoz, of which five skins from the Serra de Parintins, across the Amazon from Obidos, west of the Tapajoz, seem to be fairly typical. The males of this form are quite decidedly lunulated beneath, including even the median under parts; the females have the ochraceous sides of throat, breast, and flanks more broadly extended toward the median line, while above they are dark Olive Brown instead of dark Fuscous. The feet are like those of the Rosarinho birds. A nearly adult male from Matto Grosso is less strongly marked than the Rosarinho birds and has the feet again clearer yellow, being in all respects closer to typical *argentata* than the Madeira specimens.

Beyond Ecuador, to the northeastward, several skins from the Río Cassiquiare, in Venezuela, again depart from the normal coloration of *argentata* in much the same way as do the Rio Madeira birds, though the measurements are like those of typical *argentata* and the color of the feet remains bright yellow. The males have the color of the lateral under parts darkened, with traces of lunulate markings, and the females are dark Olive Brown above instead of fuscous. Curiously, the approach seems to be in the direction of *naevia* rather than toward *diaphora* of the Caura Valley. Direct association with *toddi* is unreasonable since the species appears to be quite absent from the lower Rio Negro and the Jamundá by which route, otherwise, there could have been a connection.

The Rio Madeiran and Peruvian ranges are connected through the upper Purús and probably the Madre de Dios, the higher branches of which find their source in that part of Perú in which the species occurs.

SPECIMENS EXAMINED

S. n. naevia.—BRITISH GUIANA: Rockstone, Essequibo River, 1 "♀" = ♂. SURINAM: Paramaribo, 1 ♀. TRINIDAD: Princestown, 1 ♂, 4 ♀. VENEZUELA: "Venezuela," 1 ♂.

S. n. toddi.—BRAZIL: Serra de Parintins, 2 ♂, 3 ♀.

S. n. argentata.—PERÚ: Puerto Indiana (north bank of Amazon), 1 ♂, 5 ♀; Orosa (south bank of Amazon), 1 ♂; Lagarto, upper Ucayali, 1 ♂, 1 ♀; Santa Rosa, upper Ucayali, 1 ♀; Río Tavara, Carabaya district, 1 ♂. ECUADOR: mouth of Río Curaray, 2 ♂, 1 ♀; mouth of Lagarto Cocha, 1 ♀. BRAZIL: Rosarinho, Rio Madeira, 5 ♂, 3 ♀; Barão Melgaço, Matto Grosso, 1 ♂. VENEZUELA: Río Cassiquiare, Merey (left bank), 1 ♂, 2 ♀; opposite Merey (right bank), 1 ♂.

NOTES ON THE GENUS *Pyriglena*

In studying the Peruvian members of the genus *Pyriglena* it became necessary to examine the forms found in other parts of South America with a view to determining their interrelationship. A number of interesting facts have thus come to light which it may be well to record, including the recognition of a new subspecies from the state of Pernambuco, Brazil, and one from the Tapajoz. The following notes are in discussion of the various observations.

A study of the plumages of some of the forms of this species has given interesting results. Three plumages appear to be recognizable in each sex. The juvenal males are largely fuscous black without a definite white area concealed at the base of the mantle feathers. There is often more or less brown on the mantle and scapulars and on a subterminal band on the upper wing-coverts, especially the greater series. The first annual plumage is more like that of the adult, with the black and white of the mantle (or other parts) not so sharply defined nor so clear, and with occasional traces of brown still remaining in some cases. The wings and tail are those of the juvenal plumage. The adults need no description here except the remark that the "colors" are sharp and clear.

Young females are not at hand in sufficient numbers to give many details, besides which the subspecific differences are such as to make a detailed statement necessary for each form. The juvenals may or may not be separable from the males of corresponding age, but probably they average browner. Females in first annual plumage resemble adult females in general aspect, except that the colors are duller and the white of the mantle, when present, less clear and sharply defined, while wing and tail are those of the juvenal plumage.

Textures vary, as is to be expected, from the extremely loose and fluffy plumage of the juvenals to the firmer, stiffer feathers of the adult, with the first annuals occupying a median position.

A further character of considerable value in distinguishing both sexes in first annual plumage from those in adult dress is the comparative size and shape of the outermost primary-coverts. In the juvenal wing, which persists through the first annual stage, the obvious outermost covert (the tenth, counting from within) is relatively broad and rounded at the tip and more or less of the same length as the ninth, sometimes being a little longer but often shorter and never longer than the eighth. In fully adult birds the tenth covert is slender, acute at the tip, stiffened, distinctly longer than the ninth, and slightly longer than the eighth.

During the examination of the primary-coverts, the interesting discovery was made that a remicle, or eleventh primary, is of irregular occurrence in this species. It occurs apparently in all the subspecies but not in all the individuals and, when present, is variable in size up to nearly the length of the outermost obvious primary-covert which does not, however, belong to it. The covert of the remicle is exceedingly small. Gadow, in his table of the families of birds with reference to the development of the primaries, places the Formicariidae in the group in which this feather is not developed. Evidently the occurrence is exceptional. In a hasty glance at several allied genera, I have been unable to discover a similar development though it is a matter for which a closer watch should be kept in the future.

A series of males of *leucoptera* taken in Bahia in January, May, June, July, August, and September, shows a young bird in early post-juvenal molt on June 19 and another in nearly complete first annual plumage on the same date; June 21 and July 11 show birds in first annual molt which the age of the preceding juvenal specimens would suggest is a post-nuptial molt. April 11 and 15 give birds also in first annual molt though from a different area in the range of the form (vicinity of Rio).

In *castanoptera*, a series of females gives a fairly good idea of the general trend of the molts. The juvenal females are quite fluffy and dull blackish or brownish on head, upper tail-coverts, and under parts, dull brown on the back with no suggestion of white at the bases of the mantle feathers; first annual specimens have more blackish head and under parts and a lighter brown back, with more or less white concealed and with traces of a dusky area between the whitish bases and brown tips, not so clear as in the adults.

In an Ecuadorian series, a juvenal bird taken January 21 has the first trace of post-juvenal molt. A November 11 bird is in first annual plumage with the beginnings of the first annual molt. Two birds, dated January 22 and 24, are nearly fully adult including new wings and tail. An August 5 bird is fully adult. An adult January male had enlarged testicles.

A Colombian series indicates somewhat later dates for the corresponding stages. May 14 and 19 show the beginnings of the post-juvenal molt and May 13 a more developed stage of the same, while May 14 shows a well-advanced stage of the first annual molt. Adult males of May and June are marked as having enlarged testicles.

A March female of *castanoptera* has the ovaries slightly enlarged and is just completing a molt of the rectrices; the wing is just beginning a molt; the body plumage is fresh. A May 23 adult female is in full molt (apparently post-nuptial?). A February male from the locality of the March female is in advanced annual molt and is labeled as with testicles much enlarged. A March male from the same place is farther advanced, with testicles only slightly enlarged. These data again point to the molt being post-nuptial. A third female from another locality in

Perú, dated August 27, is apparently in first annual plumage, with traces of the juvenal on the occiput and with wing and tail complete and still juvenal. The concealed patch on the mantle is only a little duller than in the adult bird. The March female is not unlike this specimen in many particulars and differs principally by reason of the wing which shows the characters of the adult in one, of the immature in the other.

In *picea*, two adult males of May 7 and May 14, respectively, are labeled as with enlarged testicles and are near the end of an annual molt. A young male of May 3 is in its first annual molt, with numerous brown feathers of the first annual plumage still in place on the back and lower under parts and with some of the new black mantle feathers marked by faint brownish tips. Since I have no males of *picea* in full first annual plumage for comparison, I am unable to say whether or not brown feathering is a character of that plumage of the males in this form or whether this specimen is gynandromorphic.

The general conclusions reached from a study of all the material is that the time of the post-nuptial molt of the adults corresponds fairly closely with that of the post-juvenal and first annual molts of the young. The post-juvenal molt apparently is complete for the body plumage but does not affect the wings and tail. The first annual plumage is then worn until after the following breeding season when the first annual molt occurs, and the succeeding annual post-nuptial molts take care of the following regular changes of plumage.

Pyriglena leucoptera leucoptera (Vieillot)

Turdus leucopterus VIEILLOT, 1818, 'Nouv. Dict. Hist. Nat.,' nouv. éd., XX, p. 272—"Brésil" = neighborhood of Rio de Janeiro; cotypes in Paris Mus.

A good series of the present form is at hand from numerous localities in the states of Rio de Janeiro, Santa Catharina, southern Matto Grosso, Espirito Santo, São Paulo, Paraná, Minas Geraes, and north-central to south-central Bahia, Brazil, and from Misiones, Argentina. All the males have the white shoulder and white wing-bars that define this form, but not in perfectly uniform degree. Specimens from the northern part of central Bahia (Jaguarary, Ituassú, and Baixão, and two "Bahia" trade-skins) have the outer margin of the alula broadly white, forming a white stripe connecting the shoulder-patch and the lower wing band, but this stripe is entirely lacking in all but one of twenty-seven males from more southern localities; the exception is one of the males from Guayra, Paraná, in which the character is developed noticeably less strongly than in the birds from northern Bahia. Nevertheless, Hellmayr (Abh. K. Bayer. Akad. Wiss., II Kl., XXII, (3), p. 621, 1905) describes males from Rio and São Paulo as having a white border on the alula and outer primary-covert, so it is possible that the absence of this character in the birds at hand from those regions is purely incidental. The females show no definite characters. If a separable form should prove to be distinguishable from northern Bahia, Lichtenstein's *Lanius domicella* from Bahia would have to be examined as well as Swainson's *Drymophila trifasciata* from "S. Brazil," the figure of which latter bird shows the white border on the alula.

In other particulars the variations are without regard to locality. The width of the wing-bands is quite variable and the lower band is sometimes relatively narrow; in young birds it is sometimes reduced to a series of small whitish spots. The white shoulder-patch is frequently invaded by blackish areas on the feathers between the bases, and the tips and the gray bases may also be much widened so as to reduce the extent of white. Taken in conjunction with the fact that white markings sometimes appear on the shoulders of *P. l. marcapatensis* and *P. l. leuconota*, as detailed thereunder, and that there is very close approximation between the females of *leucoptera* and *P. l. pacifica*, except for the white interscapular patch of *pacifica* (a most variable character in the Formicariidae), the evidence points strongly to the specific unity of *leucoptera* and the members of *leuconota* group, and I have so considered the species.

The females have the upper part of the grayish lores slightly paler than the lower portion and separated from the rufous crown by a barely indicated dusky line. The pattern suggests the strongly marked superciliary stripe of *maura* which, in that form, is not quite uniformly developed. The rufescence of the upper parts in the females of *leucoptera* also is slightly variable.

The record from southern Matto Grosso ("Campanario, São Francisco Ranch") constitutes an extension of the known range of this form as do the records from northern Bahia.

Probably *P. atra*, which seems to be confined to the immediate environs of the city of Pará, should be treated as a subspecies of *leucoptera*. Its range is confined to the coast or coastal forests, so far as known, but is surrounded on three sides by that of *leucoptera* which does not conflict with it. Unfortunately no specimens of *atra* are available for comparative study.

Pyriglena leucoptera leuconota (Spix)

Myothera leuconota Spix,' 1824, 'Av. Bras.,' I, p. 72, Pl. lxxii, fig. 2—Pará; ♀; Munich Mus.

Specimens from eastern Pará and Maranhão seem to be relatively uniform in color and size and to belong to the present subspecies. Examples from eastern Pernambuco, however, are recognizably distinct in both particulars and in view of their apparently quite unconnected distribution may well be separated as a distinct subspecies, which is described hereunder.

One male from Utinga and one from Cametá show quite pronounced white markings on the outer scapulars and, in the Utinga specimen, also on the lesser upper wing-coverts. The other males are without such white. The variation seems to be pointedly in the direction of *leucoptera.*

Pyriglena leucoptera pernambucensis, new subspecies

Type from Brejão, Pernambuco, Brazil; altitude 2500 feet. No. 243,131, American Museum of Natural History. Adult female collected February 11, 1927, by E. Kaempfer; original number 4387.

Diagnosis.—Nearest to *P. l. leuconota* but with a longer tail. Females distinctly darker than those of *leuconota,* less reddish brown above, with the blackish subterminal border of the mantle feathers more pronounced and more sharply defined from the white bases, with a noticeable tendency to extend basally along the shafts in a small point; upper and under tail-coverts more sooty; ear-coverts darker; under parts decidedly darker and more grayish, less ochraceous, being nearer the color of *leucoptera* though slightly more buffy; bill slightly darker. Males colored very like *leuconota* but with the black tips of the feathers of the mantle frequently tending to extend basally along the shafts in a small point, not crossing the shafts so straightly as in *leuconota;* bill black to the tip.

Range.—Eastern portion of the state of Pernambuco, Brazil.

Description of Type.—Exposed portions of the plumage of the upper back Prout's Brown; top of the head inclined toward Auburn with a more or less distinct central (concealed) area of more dusky brown; mantle with a large, concealed patch of white occupying most of the feathers and separated from the brown tips by a blackish band, graduated into the color of the tips but sharply defined from the white area; this black band extends slightly basad in a point along the shaft; lower back darker and duller brown, which passes into sooty black on the upper tail-coverts. Lores Deep Mouse Gray, more dusky on the lower portion, paler on the upper portion and continued posteriorly over the orbit to past its middle and separated from the crown by an obscure dusky line; forehead also tinged with dull gray; auriculars slightly duller than the crown and with a buffy line on the lower edge posteriorly; malar region light smoky gray. Chin rather broadly whitish, passing into pale, dull Cinnamon-Buff on the throat; sides of throat and breast broadly Buffy Brown x Saccardo's Umber, becoming deeper on the upper flanks and Mummy Brown on the lower flanks, leaving a narrow and ill-defined median area on the belly of a paler and more buffy tint; under tail-coverts brownish black, strongly tinged with Sepia on the basal feathers. Exposed surface of wings a little brighter than the back; remiges otherwise fuscous; bend of wing and under wing-coverts Light Brownish Olive; tail black. Wing, 74 mm., tail, 68; exposed culmen, 17; culmen from base, 22; tarsus, 29.

REMARKS.—Male entirely black, except for a broad, concealed patch of white on the mantle, occupying most of the feathers and with the line of demarcation from the black tips sharply defined and tending to extend basad along the shaft in a small point; black tips relatively narrow as in *leuconota* and *leucoptera*. Males: wing, 79–82 mm. (av., 80.6); tail, 73–78.5 (av., 75.4); exposed culmen, 15–18 (av., 16.9); culmen from base, 21–23 (av., 21.9); tarsus, 29–31.5 (av., 30). Females (type and paratypes): wing, 74–77 mm. (av., 75); tail, 68–72 (av., 70.1); exposed culmen, 17–18 (av., 17.7); culmen from base, 22; tarsus, 28.5–29 (av., 28.7).

I am unable to see any difference in the size of the bill of this form and that of *leuconota* as indicated by Hellmayr (Abh. K. Bayer. Akad. Wiss., II Kl., XXII, (3), p. 623, 1905). Measurements of *leuconota* in the series at hand show the following figures. Males : wing, 76.5–81 mm. (av., 78); tail, 65.5–71.5 (av., 68.6); culmen from base, 21–22 (av., 21.4). Females: wing, 69–75 mm. (av., 72); tail, 62.5–67.5 (av., 64.3); culmen from base, 20.5–23 (av., 21.6). The length of the tail appears to be constantly different in the two forms and furnishes the best guide for the separation of the males.

The approach shown by the females toward *leucoptera*, in the coloration of the under surface, no doubt is significant in view of the relationship which is demonstrated in some of the other subspecies, as indicated elsewhere.

Pyriglena leucoptera similis, new subspecies

TYPE from Caxiricatuba, Rio Tapajoz (right bank), Brazil. No. 248,847, American Museum of Natural History. Adult female collected May 20, 1931, by A. M. Olalla.

DIAGNOSIS.—Strikingly similar to *P. l. picea* of central Perú from which it is separated geographically by a wide range of country. Males inseparable from those of *P. l. leuconota* of Pará and distinguishable from those of *P. l. picea* by a harder, glossier plumage and possibly longer bill; the feathers of the chin seem to be more blackish at the base. The female of *similis* is more brightly rufescent on the under parts, especially laterally, and somewhat paler rufescent on the upper parts; the blackish head and throat appear to be more sharply defined from the rufous of the breast and back as described below.

RANGE.—Lower Amazonia east of the Rio Tapajoz, not extending eastward farther than the Tocantins and possibly not so far (region between the Xingú and the Tapajoz uncertain).

DESCRIPTION OF TYPE.—Head all around to crown, superciliary region, posterior auriculars, and lower throat blackish; middle of crown to hind neck, sides of neck, and lower border of throat browner with blackish tips, forming a transitional area in which the amount of rufous increases from crown to nape and the width of the black tips decreases. (In *P. l. picea* the transition takes place by a different method. The tips of the feathers are rufous and the subterminal portion blackish, and the width of the rufous tips increases from crown to nape until the blackish portion of the feathers is entirely concealed. The transition thus appears more abrupt in *similis* than in *picea*.) Back and rump Argus Brown with a tinge of Auburn; mantle with a concealed patch of white at the bases of the feathers, separated from the rufous brown tips by an ill-defined dusky area; upper tail-coverts blackish, tipped with Prout's Brown; breast Argus Brown x Brussels Brown, with traces of blackish tips, becoming slightly paler and duller, approching Saccardo's Umber, on the mid-line of the belly; sides of breast and flanks somewhat brighter and more reddish than Argus Brown. Wings Fuscous Black with exposed surfaces dark Auburn; under wing-coverts paler, mostly like the breast but the series at the base of the primaries grayish; inner margin of quills Drab-Gray; tail black with outer margins at base slightly brownish; outermost rectrix with a fine, white, terminal speck. Maxilla blackish (in dried skin); mandible whitish; feet brownish black. Wing, 78 mm.; tail, 78; exposed culmen, 16.5; culmen from base, 20; tarsus, 29.25.

REMARKS.—Males moderately glossy black with a sharply defined patch of white concealed at the bases of the mantle feathers. One of the adult males has a large amount of white at the bases of the scapulars, the inner upper wing-coverts of all three series, and even the innermost tertial.

A young male from Piquiatuba, taken May 23, apparently is passing from juvenal into first annual plumage. It is largely Sooty Black on head and mantle, nearer Dark Quaker Drab on rump and under parts. The apparently juvenal feathers of the mantle are without white, whereas the newly arriving feathers of the first annual plumage have distinct whitish sub-basal areas which are, however, distinctly less pure and less sharply defined than the white of the mantle feathers of fully adult birds; the new feathers also are deeper black at the tips than the juvenal ones and, quite naturally, somewhat more compact in texture, while compared with fully adult plumage they are less deeply black and a very little looser in texture. The tail feathers are all still in the sheaths though fully grown; the remiges have lost the remains of the sheaths.

A somewhat older male from Caxiricatuba, taken May 5, is leaving the first annual plumage for the adult and is labeled as having the testicles enlarged. Wings and tail have not been molted; the forehead is adult but the rest of the top of the head is just beginning the molt; the mantle shows many clear black and white feathers, including several in process of growth, with a number of the duller first annual feathers still in place;

the lower back is dull; the under surface is advanced in molt anteriorly, beginning the molt posteriorly.

Pyriglena leucoptera maura (Ménétriès)

Formicivora maura Ménétriès, 1835, Mém. Acad. Sci. St. Pétersb., (6), III, pt. 2 (Sci. Nat.), p. 506, Pl. vii, fig. 1—"Minas Geraes," errore = Matto Grosso (Hellmayr, 1924); ♂; Leningrad Mus.

Five males and four females from Urucum and Tapirapoan, Matto Grosso, represent this subspecies in the collection. The females have the tips of the upper wing-coverts slightly paler than the remainder, suggesting, in an obscure manner, the wing pattern of the males of *leucoptera;* the males have their plumage somewhat softer than that of *leuconota* and *hellmayri,* with suggestions of glossy margins on the feathers of a different nuance, giving a slightly different appearance to the plumage in certain lights. The black margins on the mantle are rather wider than in *leuconota* and less sharply defined from the white base, due to a tendency for the black to become brownish at the line of demarcation, while in *leuconota* it remains black to the very edge.

No definite differences in size are observable between *maura* and *leuconota.*

The Tapirapoan specimens seem to be equivocal and could be referred to *hellmayri* about as satisfactorily as to *maura.* The male is not fully adult, but such adult plumage as it has is of the harder texture of *hellmayri;* the measurements are equivocal. The female is very distinctly lighter in color than those from Urucum; the back and flanks are more olivaceous brown, and the general color of the under surface is much paler buff and less deep ochraceous. Above the eye, the superciliary stripe is buff instead of white and there is less of a whitish tinge below the eye. The measurements agree better with those of *maura* than with those recorded for *hellmayri,* of which I have no females.

However, Hellmayr has assigned a series of specimens from Engenho do Cap. Gama to *maura,* and Tapirapoan is between that locality and Urucum, so the Tapirapoan specimens must be called *maura,* at least until a larger series from that locality is at hand for study.

Pyriglena leucoptera hellmayri Stolzmann and Domaniewski

Pyriglena leuconota hellmayri Stolzmann and Domaniewski, 1918, Compt. Rend. Soc. Sci. Varsovie, XI, fasc. 2, pp. 179, 184—Chulumani, Yungas, western Bolivia; Warsaw Mus.

Four males are at hand, three from Vermejo and one from Mapiri, Bolivia, but no females. The males are not clearly separable from those of *marcapatensis*, except by slightly shorter bill, but the tail is usually longer than that of *maura* and the texture of the plumage is slightly "harder," as exhibited by the series at hand.

Pyriglena leucoptera marcapatensis Stolzmann and Domaniewski

Pyriglena leuconota marcapatensis STOLZMANN AND DOMANIEWSKI, 1918, Compt. Rend. Soc. Sci. Varsovie, XI, fasc. 2, pp. 180, 185—Huaynapata, Marcapata, southeastern Perú; ♀; Warsaw Mus.

Two females from the Carabaya district of southeastern Perú agree well with the description of this subspecies, as do three males from the same region.

One of the females (from Santo Domingo) is a little less rufescent than the other (from the Río Tavara); the upper parts are more yellowish brown, the under parts more ochraceous, including the auriculars; the chin is more extensively white, the white subocular lunule is more pronounced, and the posterior part of the superciliary stripe is whiter, less buffy. These features show a variation in the direction of *maura* of western Matto Grosso, Brazil, from which the Santo Domingo bird is separable principally by a generally darker coloration.

A Río Tavara male has quite distinct, though small, white markings on the lesser upper wing-coverts at the radial margin of the wing. This, as in the case of *leuconota*, apparently indicates the close relationship of *leucoptera*.

Pyriglena leucoptera picea Cabanis

Pyriglena picea CABANIS, 1847, Arch. Naturg., XIII, (1), p. 212—Peru = Chanchamayo (Hellmayr, 1920); ♂; Neuchâtel Mus.

The present form is known definitely only from the subtropical zone of the highlands in the Junín region. Collected there first by Tschudi, it was found subsequently by Jelski and Kalinowski, and six skins from Tulumayo, Chelpes, and Utcuyacu, collected by Watkins, add other records to the list from the same general region.

To the northward, south of the Marañón, only two specimens have been taken and both of these are males—one from Nuevo Loreto and one from Vista Alegre. Beyond the Marañón, as will be detailed below, *castanoptera* replaces *picea*, still in the subtropical zone, and continues northward into eastern Ecuador and Colombia. The males of this form are indistinguishable from those of *picea* and the question thus arises as to whether the Nuevo Loreto and Vista Alegre birds represent *picea*, *castanoptera*, or some unknown form, intermediate or not between these two. Judging by the distribution of various other Peruvian birds, and by the distinctly restricted ranges inhabited by most of the forms of the present species, it is probable that the birds from the Huallaga Valley either are *picea* or some unknown race and are not *castanoptera*. Until females are taken in the Huallaga drainage, it will be impossible to settle the status of that form with any greater certainty.

A young male from Tulumayo, taken on May 25, 1921, shows the immature plumage of that sex to be largely black, though with a brownish tone and with brownish tips on the greater upper wing-coverts, and with no more than a suggestion of the white interscapular patch. Another male from Chelpes, taken on May 3, has acquired more of the adult plumage, but the remains of the immature plumage are decidedly more rufescent than in the Tulumayo bird, and some of the newly acquired black feathers of the back have slight suggestions of the same rufescent tone at the extreme tips.

Pyriglena leucoptera castanoptera Chubb

Pyriglena castanoptera Chubb, 1916 (Febr.), Bull. Brit. Orn. Club, XXXVI, p. 47—"Braza" = Baeza, e. Ecuador, 6000 ft.; ♀; British Mus.

Two females from Santa Rosa (near Tutumberos), 6100 ft., and two males and a female from Chaupe (near San Ignacio), 3900 ft., show that the range of *castanoptera* extends southward into Perú. Comparison of these birds with others from southeastern Colombia and eastern Ecuador shows very close agreement throughout this entire area. A certain amount of variation is exhibited by the females in the matter of the presence or absence of a rufescent brown suffusion on the lower flanks, but it is shown in all parts of the entire range and apparently is without taxonomic significance.

Pyriglena leucoptera pacifica Chapman

Pyriglena pacifica Chapman, 1923 (April), Amer. Mus. Novit., No. 67, p. 6—Puente de Chimbo, western Ecuador; ♀; Amer. Mus. Nat. Hist.

The extremely close resemblance between the females of this most northwesterly form and those of *leucoptera*, the most southeasterly form, probably is significant. It is possible to pick out specimens that, viewed from below, are startlingly like the females of *leucoptera*, with the throat less whitish and more grayish olive but with no other features of note. Above, *leucoptera* females are usually distinctly more rufescent (though extremes are not so decidedly marked) while the absence of a white interscapular patch in the southeast-Brazilian form furnishes a safe guide for the separation of the two subspecies.

The males of *leucoptera* have the white shoulder and white wing-bands; males of *pacifica* have the inner margins of the remiges and an occasional area on the under wing-coverts white. The measurements, which vary in the forms that occupy the intervening regions, are not widely different in these two.

On the theory that the peripheral forms not uncommonly represent the least modified survivals of the original species while the forms occupying the intervening area are the survivors of those individuals whose ability to vary allowed them to remain more stationary, this similarity between *pacifica* and *leucoptera* becomes significant. In any case this resemblance must be taken into consideration in viewing the specific relationship of the various members of the group.

SPECIMENS EXAMINED

P. l. leucoptera.—BRAZIL: (Rio) Therezopolis, Organ Mts., 1♂; Ponte Maromba, Serra do Itatiaya, 2♂, 1♀; Monte Serrat, Itatiaya, 1♂; (Santa Catharina) Palmital, 3♂, 1♀; Joinville, 1♂, 4♀; (Matto Grosso) Campanario, 1♂; (Espirito Santo) Lagôa Juparanã, 2♂; (São Paulo) Alto da Serra, 1♂; (Paraná) Foz de Iguassú, 1♂, 1♀; Guayra, 5♂, 2♀; Porto Britania, 2♂; Porto Mendes, 1♂; (Minas Geraes) São Benedicto, 1♂; Resplendor, Rio Doce, 1♂; (Bahia) Cajaseiros, Rio Grungogy, 4♂, 4♀; Jaguaquara (=Jaguarary?), 1♂; Itirussú (=Ituassú), 2♂, 1♀; Baixão, 2♂, 1♀; "Bahia," 2 (♂). ARGENTINA: (Misiones) Puerto Segundo, 1♂.

P. l. pernambucensis.—BRAZIL: (Pernambuco) Brejão, 7♂, 3♀ (incl. type).

P. l. similis.—BRAZIL: Caxiricatuba, Rio Tapajoz (right bank), 3♂, 1♀ (type); Piquiatuba, 1♂.

P. l. leuconota.—BRAZIL: (Pará) Utinga, 2♂, 2♀; Cametá, 1♂; Mocajatuba, 1♂; (Maranhão) Rosario, 1♀.

P. l. maura.—BRAZIL: (Matto Grosso) Urucum, 4♂, 3♀; Tapirapoan, 1♂.

P. l. hellmayri.—BOLIVIA: Vermejo, 3♂; Mapiri, 1 (♂).

P. l. marcapatensis.—PERÚ: Río Tavara, 1♂, 1♀; Santo Domingo, 2♂, 1♀.

P. l. picea.—PERÚ: Tulumayo, Dept. Junín, 3♂; Chelpes, 1♂, 1♀; Utcuyacu, 1♀; Vista Alegre, Dept. Huánuco, 1♂.[1]

P. l. castanoptera.—PERÚ: Chaupe, 2♂, 1♀; Santa Rosa, middle Marañón Valley, 2♀. ECUADOR: Oyacachi, 3♂, 3♀; lower Sumaco, 1♂, 1♀; Sabanilla, 1♀. COLOMBIA: Andalucia, Huila, 1♂, 1♀; La Candela, 1 ?(immature).

P. l. pacifica.—ECUADOR: Chimbo, 1♀ (type); Esmeraldas, 2♂, 2♀; Naranjo, Prov. Guayas, 4♂, 1♀; La Puente, Prov. del Oro, 1♂, 2♀; Bucay, 1♂, 1♀; Alamor, 1♂; Cebollal, 1♀.

Pithys albifrons peruviana Taczanowski

Pithys albifrons, peruviana TACZANOWSKI, 1884, 'Orn. Pérou,' II, p. 73—Monterico, Amable Maria, Chayavetas; type from Monterico, formerly in Warsaw Mus., now lost.

Thirteen Peruvian skins seem all to be referable to the same form and, so far as the adults are concerned, are mostly recognizably distinct from *P. a. brevibarba.* Specimens with uncompleted molt have the gular plumes (and crest) shorter than in the others and suggesting the style of *brevibarba*, but the lower throat is usually blacker and in fully developed individuals is less exposed.

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[1] Specimen in Field Museum of Natural History, Chicago.

A male of *brevibarba* from Tahuapunto, Rio Uaupés, Brazil, is interesting as showing the white postocular line of *albifrons.* In skins from Tatú, at the mouth of the Uaupés, there is an occasional trace of white on one or two feathers in the postocular region, but the birds are distinctly closer to *brevibarba* than to *albifrons.*

The occurrence of *brevibarba* on the Napo at the mouth of the Río Curaray makes it almost certain that it will be found at the mouth of the Napo in Perú, but at present there are no specimens to substantiate this belief.

SPECIMENS EXAMINED

P. a. albifrons.—FRENCH GUIANA, 1 ad., 1 juv. BRITISH GUIANA: Potaro Landing, 3♂, 3♀, 1 juv.; Essequibo R., 1(?); Rockstone, 1♂, 1♀; Minnehaha Creek, 2♂; Tumatumari, 1♂, 1♀; Kamakusa, 1♂, 2♀, 1(?). VENEZUELA: Caño Seco, Mt. Duida, 8♂, 5♀; Boca de Sina, upper Orinoco, 4♂, 2♀; Suapuré, 2♂; El Llageral, 1♂. BRAZIL: Faro, 4♂, 2♀; Obidos, 1♂, 1♀.

P. a. brevibarba.—ECUADOR: lower Río Suno, 3♂ (incl. type); Río Suno, above Avila, 1♂; Napo, 4(?); mouth of Río Curaray, 1♂. COLOMBIA: Río Guatequia, Bogotá region, 1(?). BRAZIL: Tatú, Rio Negro, 5♂, 4♀, 1(?); Tahuapunto, Rio Uaupés, 1♂.

P. a. peruviana.—PERÚ: Santa Rosa, upper Ucayali, 2♂; Río Seco, 30 miles west of Moyobamba, 6♂, 2♀, 1(?); Pomará, lower Río Marañón, 1♂, 1♀; Puerto Bermúdez, Río Pichis, 1♂, 1♀.[1]

Drymophila caudata caudata (Sclater)

Formicivora caudata SCLATER, "1854" (=Jan. 1855), P. Z. S. London, XXII, p. 254, Pl. LXXIV—Bogotá; cotypes in British Mus.

Drymophila caudata peruviana DOMANIEWSKI AND STOLZMANN, 1922, Discipl. Biol. Arch. Soc. Scient. Varsov., I, No. 8, p. 3—Garita del Sol, Junín, Perú.

Two skins from Junín and three from northern Perú (Chaupe) have been compared with twenty specimens from Colombia and Ecuador without finding any basis for the recognition of *D. c. peruviana*, either on the characters given by the authors or on any others.

A male from Santa Elena, Colombia, approaches *hellmayri* of the Santa Marta region by having the middle of the occiput and nape without white margins.

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[1] Specimens in Field Museum of Natural History, Chicago.

SPECIMENS EXAMINED

D. c. caudata.—COLOMBIA: Cocal, 1♂, 1(?); Gallera, 1♂; Sabanalarga, 1 (♂); Santa Elena, 3♂, 1♀; El Eden, 1♀; El Roble, 1(♂); above Salento, 1♂ (type of *D. c. striaticeps* Chapman). ECUADOR: Baeza, 2♂, 1♀; below Mindo, 1♂, 1♀; upper Sumaco, 4♂, 1♀. PERÚ: Chelpes, Junín, 1♂, 1(♂); Chaupe, 2♂, 1(♀).

D. c. hellmayri.—COLOMBIA: Minca, Santa Marta, 1(♀).

D. c. klagesi.—VENEZUELA: Cotiza, 1♂, 1♀.

Drymophila devillei devillei (Ménégaux and Hellmayr)

Formicivora devillei MÉNÉGAUX AND HELLMAYR, 1906, Bull. Soc. Philom. Paris, (9), VIII, p. 38—"n. e. Perú [Pebas or Nauta]" = Prov. Cuzco, s. e. Perú.

A single specimen from the upper Ucayali, six birds from eastern Ecuador, and eight from Bolivia show very little variation among themselves. The intensity of the rufous color of the rump and of the ochraceous color of the flanks varies without regard to locality. Possibly Ecuadorian males have an average of slightly broader white markings above, but it is almost unrecognizable. The Ecuadorian and Peruvian birds seem to have somewhat shorter tails and smaller bills than the Bolivian examples and a larger series might show a recognizable difference in these particulars, but since some of the northern specimens have the tails in molt, the evidence in that respect is not conclusive. The Ucayali bird in any case is more or less intermediate.

SPECIMENS EXAMINED

D. d. devillei.—BOLIVIA: Jatumpampa, 1♂ (type of *D. phantatis* Cherrie); Mission San Antonio, Río Chimoré, 4♂, 3♀. PERÚ: Lagarto, upper Ucayali, 1♂. ECUADOR: below San José, 3♂; Río Suno, above Avila, 2♂; mouth of Río Curaray, 1♂.

D. d. subochracea.—BRAZIL: Rio Curuá, 1♀.

Liosceles thoracicus erithacus Sclater

Liosceles erithacus SCLATER, 1890, 'Cat. B. Brit. Mus.,' XV, p. 344—Sarayacu, w. (= e.) Ecuador; cotypes in British Mus., and one in Amer. Mus. Nat. Hist.

Eleven specimens of this species are at hand from eastern Ecuador and eastern Perú, including a cotype of *erithacus*, and ten from the east bank of the Rio Madeira and the south bank of the Amazon, opposite Obidos in Brazil. The Brazilian birds presumably represent typical *thoracicus* which was described from the left bank of the Madeira. The Peruvian and Ecuadorian birds are somewhat different and substantiate the validity of Sclater's *erithacus* though on somewhat different grounds than those given by the describer.

The cotype apparently lacks any yellow on the breast, but the skin is prepared with the pectoral area foreshortened and there is actually considerable yellow on the subterminal portions of the feathers, which is concealed by the overlapping webs. If this skin had the head and neck outstretched as do the other specimens at hand, it would show no difference from some of the others in respect to the extent and tint of this coloration.

On comparing the Ecuadorian and Peruvian birds with the Brazilian skins, there is a quite noticeable difference in the tone of yellow but not always in its extent. The Brazilian *thoracicus* has the yellow more intense, varying from Citron Yellow to near Pale Lemon Yellow; in *erithacus* from Perú and Ecuador, the yellow is lighter, from Primrose Yellow to Barium Yellow. In series, the difference is pronounced. Furthermore, *thoracicus* sometimes has the throat and even the sides of the neck strongly tinged with yellow though not always. The brown pectoral patch is paler in *erithacus* and averages more extensive; the flanks average less rufescent and more sooty; the upper parts average very slightly grayer and less clear rufescent. There is no apparent difference in size. The cotype tends to invalidate the degree of rufescence, however, since it is more intensely marked than any other of either series, but as it is nearly fifty years older than the others it can not be accepted without some allowance for foxing.

The specimens of *erithacus* which show an unusual reduction in the amount of yellow on the breast have the brown patch reduced even more. An immature male from Orosa, Perú, and a more adult male from the mouth of the Río Curaray, Ecuador, have very little brown; the yellow is pale but is as extensive as in most of the other skins of this subspecies. The throat of the immature bird and the pectoral feathers, also, are narrowly tipped with dusky; there are traces of the dusky tips on the breast and sides of the throat in various other skins, though they are lacking in most of them.

Curiously, a male from Borba shows no trace of yellow on the breast, while the brownish area is pale and much restricted. It looks very like the cotype of *erithacus* which, however, has more yellow than this specimen. The lores on the left side are brownish buff, on the right side whitish, and the wings and bill are the shortest of any in both series. Probably the specimen represents nothing more than a partially underdeveloped or abnormal individual. It is not quite fully adult, though the pectoral region appears to be in adult plumage, but there is no resemblance to the immature specimen of *erithacus;* a definitely immature skin of *thoracicus,* from Lago Andirá, has the yellow and brown patch of the adult very strongly developed.

SPECIMENS EXAMINED

L. t. thoracicus.—BRAZIL: Borba, 3♂, 1♀; Igarapé Auarí, Rio Madeira, 1♂; Villa Bella Imperatríz, Lago Andirá, 4♂, 1♀.

L. t. erithacus.—ECUADOR: Sarayacu, 1(?) (cotype); mouth of Río Curaray, 1♂, 2♀; mouth of Lagarto Cocha, 2♀. PERÚ: Orosa, 1♂; Puerto Indiana, 1♂; Lagarto, upper Ucayali, 1♂; mouth of Río Urubamba, 1♂, 1♀; Puerto Bermúdez, Río Pichis, 1♂.[1]

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[1] Specimen in Field Museum of Natural History, Chicago.

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NEW AND INTERESTING WEST INDIAN HOMOPTERA

By Herbert L. Dozier[1]

This is the first of a contemplated series of papers dealing with a rather large collection of Homoptera accumulated by the writer during a period of nearly three years' residence in Haiti and Porto Rico. All types of new species described in this paper are deposited in The American Museum of Natural History, and reference has been made to certain records of material in its collections. The drawings have been carefully made by Louis Pierre-Noel of the Service Technique, under the supervision of the writer.

Fig. 1. Avocado twigs, showing old egg scars, nymphs and adults of the tree-hopper, *Platycotis* (*Lophopelta*) *tuberculatus* Fairmaire Natural size

MEMBRACIDÆ

Platycotis (Lophopelta) tuberculatus Fairmaire

Figure 1

This species is extremely abundant at Kenskoff, Haiti, where it seriously injures the terminal shoots of the avocado with its egg-punctures and feeding. *P. tuberculatus* Fairmaire (♀) and *ornata* Fairmaire (♂) are considered to be the same species by Dr. Goding. This insect serves as an outstanding example of maternal solicitude for its young. An undetermined trichogrammatid egg parasite has been reared.

Antianthe viridissima Walker

Adults and nymphs taken on *Cestrum inclusum* Urban by George N. Wolcott, on Mt. Puilsboreau, Haiti, April 4, 1926 (Acc. 26–20), were determined by Dr. Goding as this species. The writer collected specimens at Kenskoff, Haiti, August 24, 1930 (Acc. 30–250).

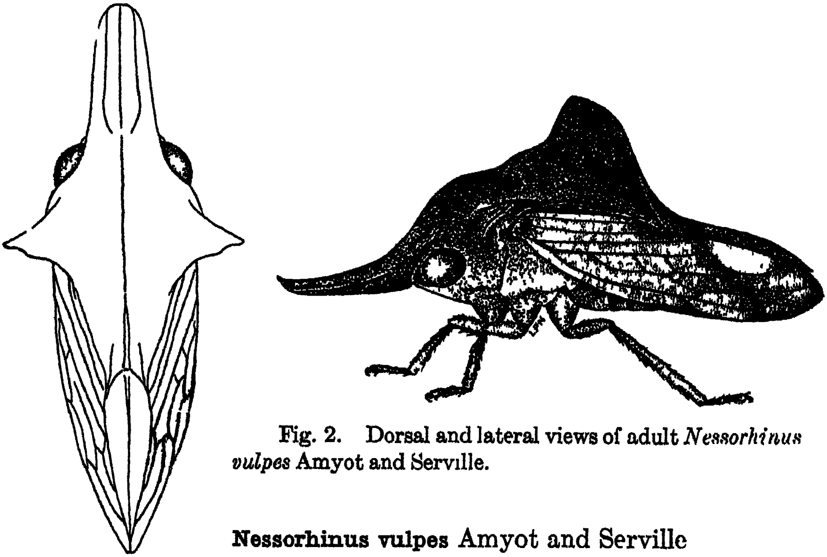

Fig. 2. Dorsal and lateral views of adult *Nessorhinus vulpes* Amyot and Serville.

Nessorhinus vulpes Amyot and Serville

Figure 2

Five adults were taken on *Cassia emarginata* at Port-au-Prince, Haiti, May 12, 1926, by George N. Wolcott (Acc. 26–29). The species was originally described from Port-au-Prince and Santo Domingo as found on "bois de campêche," *Hæmatoxylon campechianum.*

Nessorhinus gibberulus Stål

This is the most abundant and common species of membracid in Porto Rico. The records under *Antianthe expansa* Germar in Wolcott's 'Insectæ Portoricensis' should be referred to this species.

Nessorhinus graciloides, new species

Figure 3

Closely related to *N. gracilis* Metcalf and Bruner from Cuba; differs at once in the shorter and less slender elongate dorsal process, and the distinctly shorter lateral processes. Furthermore the posterior process is black with white patches instead of yellowish testaceous.

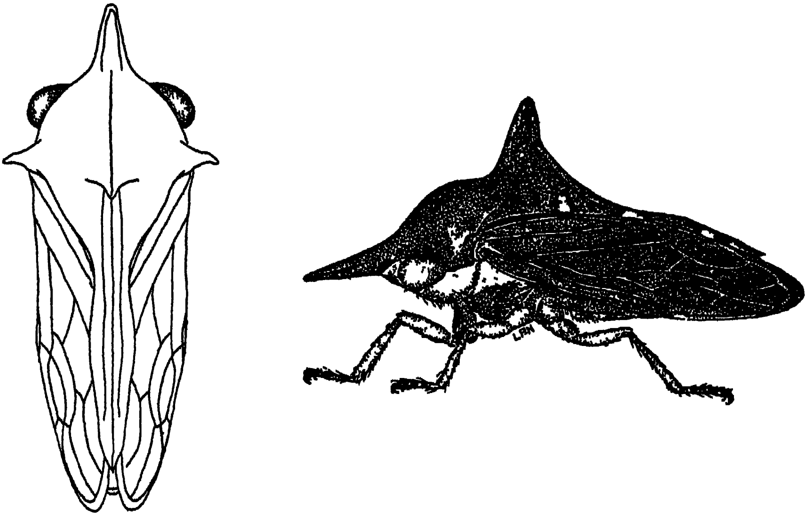

Fig. 3. Dorsal and lateral views of adult *Nessorhinus graciloides*, new species.

General color a dark brown-black, covered very lightly with inconspicuous grayish hairs; clumps of grayish-white hairs form a distinct whitish stripe along the lower side of the thorax, and four whitish spots along the posterior process, the apical spot being much smaller than the others; tegmina semiopaque fuscous black, the veins paler; venter fuscous; eyes and legs reddish testaceous.

The anterior process rather short, strongly deflexed, distinctly narrowing to apex, with two longitudinal lateral carinæ, decidedly closer to the lateral margins than to each other; pronotum densely punctate; lateral processes or horns very short, distinctly turned; dorsal process compressed, comparatively short, subacute at tip, the sides sloping downward, reminding one of a mountain peak; posterior process elongate, slender, following the contour of the tegmina but distinctly shorter than the latter.

Length, apex of anterior process to apex of tegmina, male, 7 mm.; width across lateral processes, male, 2.80 mm.

Described from a single male taken by the writer from an undetermined shrub at Caguas, Porto Rico, May 24, 1925.

CICADELLIDÆ

Protalebra similis Baker

Port-au-Prince, Haiti: January 3, 1930, on sweet potato foliage. This plant appears to be a true host plant for this small species, as the writer has also taken specimens from the sweet potato at Vega Baja, Porto Rico, October 15, 1924.

Empoasca minuenda Ball

This extremely small species is very common, everywhere in Haiti, on avocado foliage.

Macropsis rugicollis Dozier

Fond-des-Nègres, Haiti: the writer took a series of twenty-five specimens on June 12, 1930, by beating tall shrubbery (Acc. 30–191). Although not definitely established, it is believed that "Feuilles sirop," *Piper amalago*, is its host plant. The species was originally described in 1927 from two males from Cerro del Cacique, Santo Domingo, at an elevation of 5000 feet. Some of the Haitian specimens have the elytra covered with a bluish bloom. Four females were taken by George N. Wolcott at The Citadel, Milot, Haiti, May 21, 1925 (Acc. 25–410).

Deltocephalus nigripennis DeLong

Post Chabert, Haiti: a specimen taken by Dr. Wolcott January 3, 1927 (Acc. 27–193).

Xerophlœa viridis (Fabricius)

A common species taken by sweeping grass at the following points in Haiti: Hinche, August 30, 1930; Mt. Puilsboreau, October 11, 1930; Cayes, September 4, 1930; and Boucan Brou, April 2, 1930.

Acinopterus angulatus Lawson

According to Dr. Lawson, the West Indian specimens generally fall under this name. Taken in abundance at the following points in Haiti: Hinche, August 30, 1930; Cayes, September 4, 1930; l'Azile, September 5, 1930; Kenskoff, August 24, 1930; Mt. Puilsboreau, October 11, 1930; Damien, August 2, 1930; and Arcahaie, March 24, 1930.

Cicadella interrupta (Signoret)

This species is one of the most common leaf-hoppers in Haiti and Santo Domingo, where it breeds on coffee, weeds, etc.; Fond-des-Nègres, Haiti, February 14, 1930, breeding on stems of coffee (Acc 30–64).

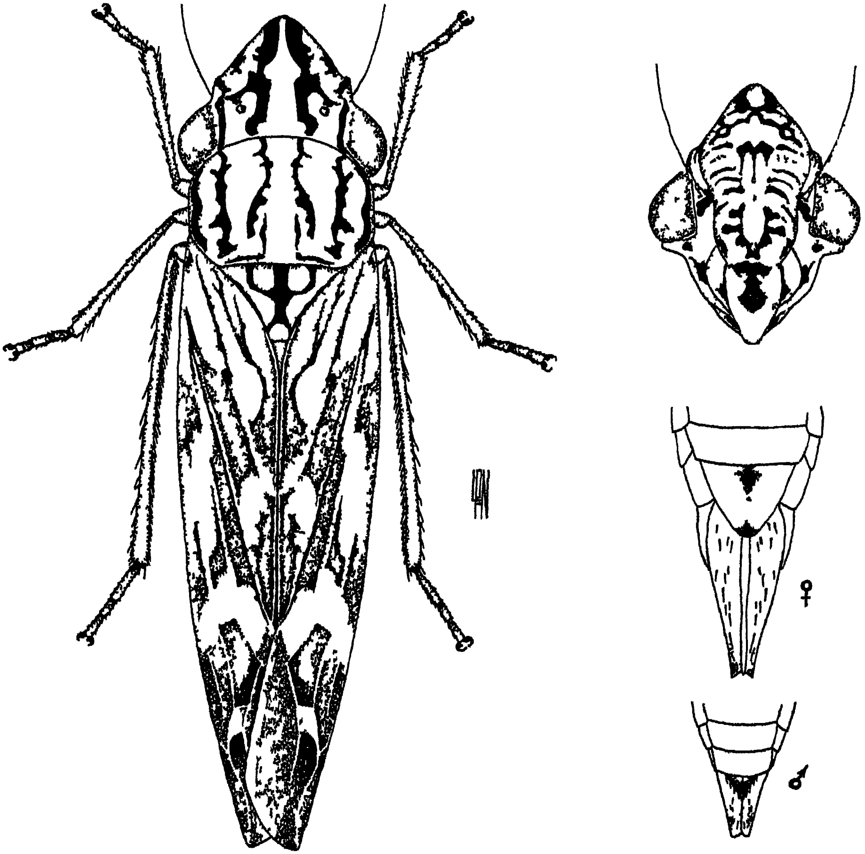

Fig. 4. Adult female *Cicadella dubiosa*, new species, frons, and male and female genitalia.

Cicadella dubiosa, new species

Figure 4

Of a general elongate appearance, this species has the greatly protruded vertex, color pattern, and distinct markings that readily differentiate it from all known West Indian species.

Vertex, pronotum, and scutellum yellowish with irregular broken black markings as in Fig. 4; the elytra with a mixture of pale lilac, olive green, and black; dorsum of abdomen red, the ventral portion pale with a black spot on each side near lateral margins, except the female segment which is marked with black at middle of its hind margin and at tip; legs pale, sparsely marked with black.

Vertex appearing greatly produced beyond the eyes, bluntly angled, as long as wide at base. Pronotum convex, narrower than the head, one and a quarter times wider than long. Elytra very long and rather narrow.

Genitalia: the female segment nearly twice as long as the preceding, the hind margin rather straight, the anterior margin produced angulate, the plates reaching slightly beyond the ovipositor; male ultimate segment well-rounded on hind margin, the plates very short and small.

Length, female, 9.25 mm.; male, 8 mm.

Described from a pair collected by the writer while beating guava bushes at Port-Margot, Haiti, October 10, 1930 and a pair collected on a stem of coffee at Fond-des-Nègres, Haiti, June 12, 1930 (Acc. 30–194). The species is common at times breeding on stems of coffee.

The two species named below, while typical of the genus *Cicadella* as long interpreted, fall into the new genus *Entogonia,* erected by Melichar ('Monographie der Cicadellinen,' 1926) in his attempt to further divide and more easily identify the exceedingly numerous and varied species heretofore placed in the heterogeneous *Cicadella.*

The two species, *Cicadella coffeacola* Dozier and *C. coffeaphila* Dozier, described from coffee in Porto Rico in 1927 (Journ. Dept. of Agric. of Porto Rico, X, July and October, 1926, pp. 263–264), fall into the subdivision *Entogonia.*

Cicadella (Entogonia) constans Walker

Figure 5

Walker, 1858, 'List of Homoptera,' British Museum, Supplement I, p. 198.

Closely related to *C. coffeaphila, coffeacola, occatoria,* and *hispaniola* but distinguished immediately by the markings on vertex and frons.

General color shiny green with black longitudinal stripes; vertex pale bluish-green, with two broad black longitudinal vittæ that divide just before the anterior margin, the inner branches joining again upon the tip of the vertex and the outer branches running downward on to the greenish frons and merging with the dark coloring of the lower portion of the frons; the vittæ of the vertex are continued on pronotum and scutellum as distinct broad stripes or bands; in addition, a narrower, lateral stripe is present on each side of pronotum near the lateral margin; elytra dark to pale greenish, striped with black; legs characteristically a distinct orange-yellow.

Vertex slightly shorter than basal width, greatly produced beyond the eyes, nearly two-thirds as long as the pronotum, obtusely rounded. Pronotum convex, about as broad at posterior margin as the head. Elytra long and narrow.

Genitalia the female segment about twice as long as the preceding, the hind margin not distinctly emarginate nor angled, the plates yellow with a median black stripe, ovipositor black Male ultimate segment well rounded on hind margin, plates broad at base, narrowed in triangular fashion to acute points that are barely exceeded by the pygofers

Length to tip of elytra female, 7 25 mm , male, 6 25 mm

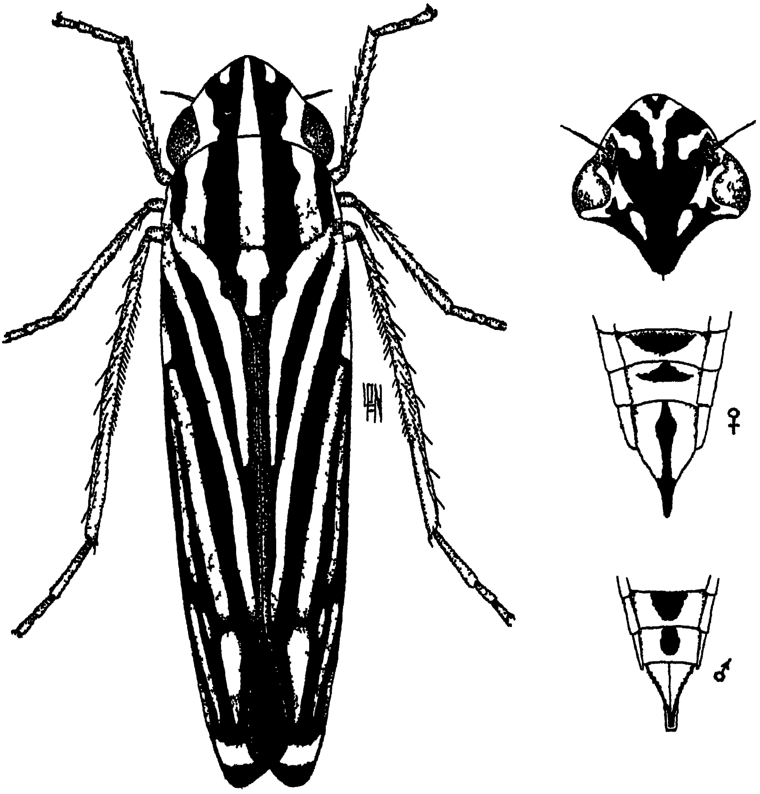

Fig 5 Adult female *Cicadella* (*Entogonia*) *constans* Walker, frons, and male and female genitalia

Description made from a series of both sexes collected by the writer at Kenskoff, Haiti, June 19, 1930, on apple and avocado (Acc 30–208), August 10, 1930 (Acc 30–236), and June 6, 1931 (Acc 31–104), several taken sweeping on Mt Puilsboreau, Haiti, October 11, 1930

This species has heretofore been known only from the original description based on three females from Port-au-Prince It appears to be abundant in the mountains at high elevations

Cicadella (Entogonia) hispaniola, new species

Figure 6

Very close in general appearance to *C constans* Walker but immediately separated by the more blunt vertex, smaller size, and different markings on the vertex and frons

General color greenish with black stripes, vertex pale yellowish with two very broad, irregular black longitudinal bands or vittæ that continue without dividing on to the frons, being very broad at apex of vertex and narrowing as they follow down the frons to the black clypeus, the two broad vittæ of the vertex are continued on to the pronotum and scutellum, in addition, on each side of the pronotum is a very narrow longitudinal stripe very close to the lateral margin, elytra with the costal area, a fine line along the commissural margin, and a short, partial, median stripe at base of clavus, pale blue, on clavus, following along the claval suture, is a narrow stripe of an olive-green color, terminating in pale blue, a second somewhat oblique longitudinal, similarly colored stripe is found along the middle of the elytra

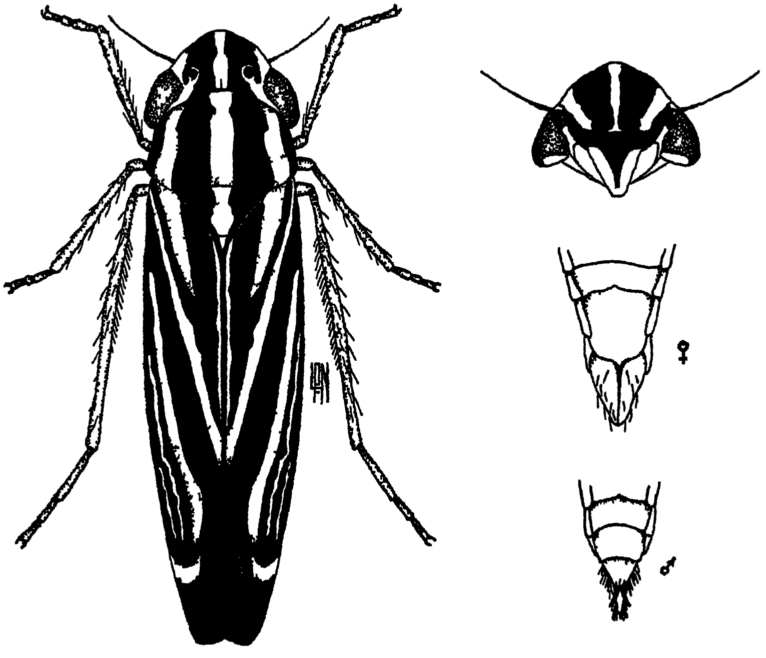

Fig 6 Adult female *Cicadella (Entogonia) hispaniola,* new species, frons, and male and female genitalia

Vertex distinctly shorter than basal width, produced beyond the eyes but obtusely or bluntly rounded, slightly over half as long as the pronotum Pronotum convex, about as broad at posterior margin as width of head, including eyes Elytra rather long and narrow

Genitalia female segment over twice as long as the preceding, the hind margin slightly angularly emarginate, somewhat keeled along the median line, the apex slightly produced Male ultimate segment well-rounded on posterior margin, plates broad at base, rapidly narrowed to long, acute, distinctly flaring or divergent tips that are slightly exceeded by the pygofers

Length to tip of elytra female, 6 25 mm , male, 5 50 mm

Described from a series of both sexes taken by the writer at Kenskoff, Haiti, June 19, 1930 (Acc 30–208), several, sweeping roadside vegetation on Mt Puilsboreau, Haiti, October 11, 1930 Taken at similar elevations in the mountains, as *C constans*, but apparently less common.

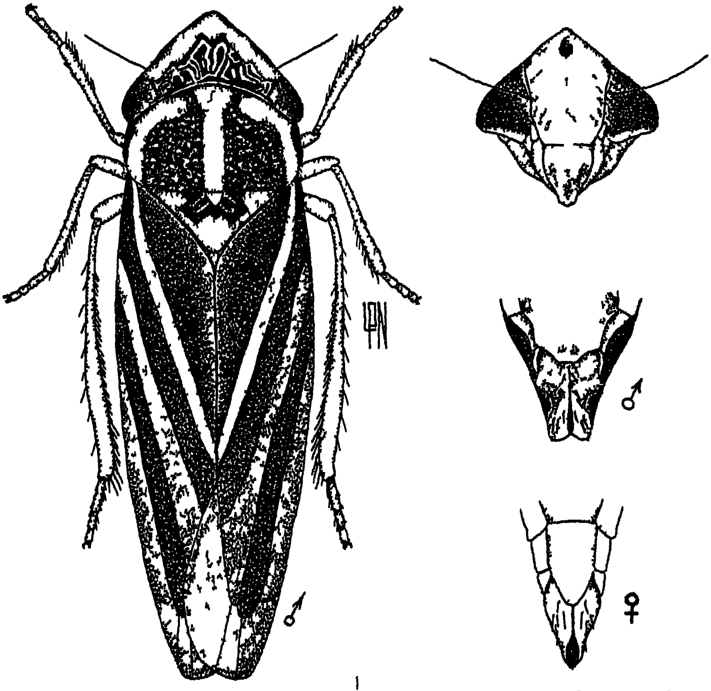

Fig 7 Adult male *Graphocephala haitiensis*, new species, frons, and male and female genitalia

Graphocephala haitiensis, new species

Figure 7

A medium-sized, beautiful species with dominant coloration of orange and violet-blue that immediately attracts attention

Nearly two-thirds of the posterior part of the vertex is of a violet-black ground color with an irregular hieroglyphic-like pattern of grayish markings, the anterior band of the vertex is a beautiful orange with broken black lines along margin; eyes brown-black. Most of the pronotum is of a violet-blue color with the margins of this area and numerous transverse irregular markings black; the remaining portion of vertex orange, so arranged that there appears to be a wide median vitta, with one on each side which extends along the anterior margin and continues almost to the median vitta. Frons is very pale in color with more or less indistinct broken oblique stripes on sides and a very characteristic small black dot near apex of vertex. Vertex flattened, distinctly shorter than the pronotum, acutely produced, nearly right-angled; the vertex is more bluntly produced in the female and the margins are more perceptibly convex. Frons distinctly convex. Elytra of moderate length.

Scutellum orange, the anterior portion on disk with two irregular areas of pale greenish outlined with heavy black; inner two-thirds of the clavus a violet-blue color, the outer third orange, the latter color appearing as an oblique longitudinal stripe; then follows a broader oblique stripe of violet-blue, a second stripe of yellowish orange; the remainder is dark green; in the female the orange color of the elytra appears more yellowish. Legs a rose-violet tinge.

Length to tip of elytra: female, 6.25 mm.; male, 5.50 mm.

Described from holotype female collected by sweeping and beating vegetation on Mt. Puilsboreau, Haiti, October 11, 1930, and allotype male taken in the mountains at Kenskoff, Haiti, August 24, 1930 (Acc. 30–248); a male taken by George N. Wolcott at Kenskoff, April 26, 1927 (Acc. 27–55).

Graphocephala dominicana, new species

Differentiated from *G. haitiensis* by its larger size and striking blue and red coloration.

Vertex red, with an irregular hieroglyphic-like pattern of gray and black occupying the posterior two-thirds; interrupted black lines along margins; pronotum, scutellum, legs, and most of under portion of abdomen, red; on each side of the disk of pronotum with a large blue-colored area, whitish in its upper outer angle, that occupies nearly two-thirds of the entire surface; the blue areas are separated by a median longitudinal stripe of the red ground color. On each side of the pronotum is also a distinct white vitta running along the lateral border which is outlined on its inner side with a narrow black edging. Frons pale-colored without definite markings. Elytra a beautiful dark blue with two short oblique stripes or vittæ of a very dark red.

Vertex flattened, nearly two-thirds as long as the pronotum, distinctly and acutely produced before the eyes, frons somewhat convex but distinctly flattened longitudinally on disk. Elytra rather long.

Length to tip of elytra: female, 7.25 mm.; male, 6.75 mm.

Described from five females and five males collected by Francisco Sein, on shrubbery, at about 5000 feet elevation in mountains near Cerro del Cacique, Santo Domingo, December 17, 1924.

Phlepsius smithi, new species

Figure 8

Readily recognized by its very large size and distinct maculation of elytra.

Vertex rusty yellowish, with two spots on posterior margin; pronotum rusty yellowish with irregular fuscous markings; frons fulvous with pattern of fuscous markings. Elytra whitish with very distinct fuscous points and splotches. Body beneath pale fulvous. Legs pale, marked with fuscous. The color of the single male at hand is decidedly paler than that of the female.

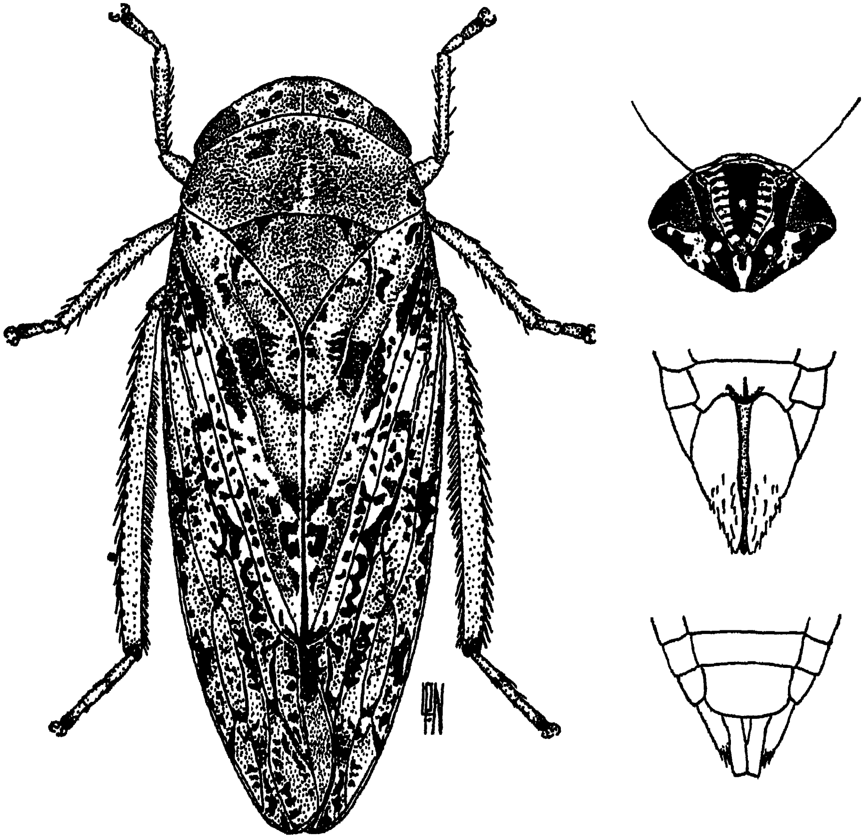

Fig. 8. Adult female *Phlepsius smithi,* new species, frons, female and male genitalia.

Head narrower than the pronotum; vertex sloping, two and a half times as wide as long, broadly rounded; the ocelli prominent. Frons rather long and narrow, flattened and impressed near its base. Pronotum twice as wide as long, convex, transversely wrinkled. Elytra long, distinctly exceeding the abdomen.

Genitalia: female ultimate ventral segment slightly longer than the preceding, the posterior margin concave on either side of the distinctly produced but well-rounded median apex.

Length of female, 8.75 mm.; of male, 7.75 mm.

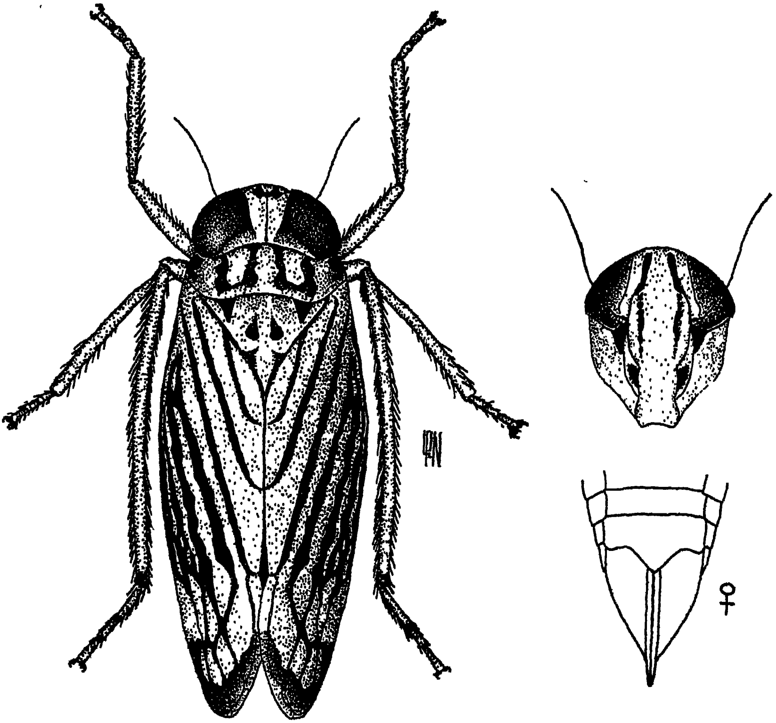

Fig. 9. Adult female *Jassus wolcotti*, new species, frons, and female genitalia.

Described from two females taken by the writer at lights at Petionville, Haiti, June 12, 1930, and a male taken on leaf of a large wild fig tree, *Ficus* species, near Williamson, Haiti, August 20, 1931.

This beautiful species is named in honor of my predecessor, Dr. Roger C. Smith, former Chief Entomologist of the Service Technique.

Jassus wolcotti, new species

Figure 9

Easily recognized by its yellowish-tan color with black markings.

General color of the head, frons, legs, and under surface, pale testaceous; the vertex pale with a narrow transverse infuscation just beneath the pair of prominent dark-reddish ocelli at the anterior margin; near the posterior margin is a pair of dark impressed spots; eyes dark brown; pronotum and scutellum with four continuous longitudinal black vittæ, irregular in thickness; lateral margins of pronotum also outlined with black; frons pale, with two median, longitudinal fuscous vittæ running its length to the clypeus; these vittæ somewhat transversely interrupted for the lower two-thirds of their length; two fuscous cloudings beneath the antennal sockets; a slight infuscation along the sides of the loræ at middle. Elytra with the veins of the clavus and corium black, slightly irregular in degree of thickness of infuscation, giving the elytra a black-striped appearance; apical border thickly infuscated.

Head narrower than pronotum; vertex slightly wider along the hind margin than the median length, the anterior margin slightly produced beyond the eyes, with a distinct median impressed line; narrowed toward the base, then flaring outward along the posterior margin of the eyes, bifoveate; the ocelli slightly nearer to the lateral margins of the vertex than to each other; frons twice as long as wide, only a faint indication of a median carina; pronotum shorter than either the vertex or the scutellum. Elytra with venation very distinct, just barely exceeding the ovipositor.

Genitalia: last ventral segment of the female about twice as long as the preceding, posterior margin slightly concave on either side of the distinctly produced median half which is very slightly rounded at apex, and not having an apical slit or notch as in some species; pygofers bearing a few fine hairs, distinctly exceeded by the ovipositor.

Described from two females collected at Port-au-Prince, Haiti, one by Dr. George N. Wolcott, November, 1926 (Acc. 26–53) and the other by the writer May 1, 1931 (Acc. 31–116). The species is named in honor of Dr. Wolcott who by his careful collecting has greatly increased our knowledge of West Indian Homoptera.

FULGORIDÆ

Dysimia maculata Muir

A few adults were taken by the writer on foliage of "latanier" palm, *Coccothrinax gracilis* Burret, on hillside at Fond-des-Nègres, Haiti, February 14, 1930 (Acc. 30 75).

Acanalonia servillei Spinola

Kenskoff, Haiti: August 24, 1930; two adults beaten from "Bois senegal," *Capparis comosa* Jacquin, by the writer (Acc. 30–244).

Acanalonia viriditerminala (Lethierry)

A specimen taken on El Yunque in Porto Rico, February, 1925, by the writer is placed as this species. Four specimens collected at Aibonito, Porto Rico, July 14, 1924 (Amer. Mus. Nat. Hist. No. 3710).

Cyarda difformis Walker

Nymps and adults were found abundant, breeding on stems of "Fleur dent," *Cordia serrata*, at Port-au-Prince, Haiti, March 9, 1390 (Acc. 30–105); abundant at Fond-des-Nègres, Haiti, February 14, 1930 (Acc. 30–60); Sanchez, Dominican Republic, May 28, 1915 (Amer. Mus. Nat. Hist. No. F3682).

Pseudhelicoptera species

A single specimen of an undescribed species was taken by F. Sein on top of a pine-covered mountain at Cerro del Cacique, Santo Domingo, December 17, 1924. It closely resembles *P. nasuta* Fowler but is slightly smaller, the coloration is different, and a lateral view of the rostrum shows it to be more obtuse than pointed. It is impossible to describe this interesting species because, through an accident, the specimen lost its head after generic determination. The record is given to establish the presence of this Central American genus in the West Indies.

Parahydriena hyalina Muir

One specimen collected at Arecibo, Porto Rico, March 14, 1914 (Amer. Mus. Nat. Hist. 3523B) and one from Mayaguez, June 21, 1915 (F3979B). Originally described from a female from Lares, Porto Rico, taken June 14, 1921.

Ladella pallida (Walker)

Three specimens from Aibonito, Porto Rico, July 14–17, 1914 (3708); one from Maricao, July 27, 1914 (3724); one from Coamo Springs, Porto Rico, July 17, 1914 (3712); and one from Mayaguez, July 24, 1914 (3725). The species was originally described from Porto Rico.

Bothriocera venosa Fowler

A very common species throughout Haiti and Porto Rico on coffee, and numerous other plants. Collected by the writer at Fond-des-Nègres, Haiti, June 12, 1930; Port Margot, Haiti, October 10, 1930, on guava; and Marianni, Haiti, April 3, 1930.

Dictyophora cubanensis Melichar

One specimen from Cabanas, Cuba, September 5, 1913 (3341); one from Cerro Cabras, September 11, 1913 (3347); two from north of Vinales, September 16, 1913 (3388). Originally described from Havana, Cuba.

Cyphoceratops furcata Uhler

Two specimens taken by the writer sweeping at Port-au-Prince, Haiti, June 1, 1931.

Tangiopsis tetrastichus Uhler

Ten adults taken by the writer sweeping weeds and low shrubbery at Port-au-Prince, May 5, 1931 (Acc. 31–); one specimen from Carrefour, Haiti, January 7, 1922 (F4612); one from Bassin General, Haiti, June 22, 1930; one from Fond-des-Nègres, Haiti, February 14, 1930; one from Arcahaie, Haiti, March 24, 1930; one from Sanchez, Dominican Republic, June 7, 1915 (F3765). The writer has studied the type in the Ball Collection.

Ugyops occidentalis Muir

Three specimens taken at Narajito, Porto Rico, July 6, 1915 (F4007), and one specimen from Aibonito, Porto Rico, July 14, 1914 (3708). Originally described by Muir from a pair collected at Aibonito, July 12, 1914. This material was compared with the type by the writer.

Catonia haitiensis, new species

Figure 10

Easily recognized by the general chalky white or pale color of elytra, with the dark brown "saddle-like" area on disk of clavus.

Vertex distinctly produced beyond the eyes, the sides narrowed toward apex, almost twice as wide at base as its median length, a reddish brown in color. Frons broad at apex, roundly narrowed toward base at vertex, a very distinct longitudinal median carina, the lateral margins also carinated; pale fulvous, the upper half darkened. Pronotum pale, the mesonotum distinctly more testaceous fulvous. Elytra with a background of chalky white, with scattered irrorate fleckings of a yellowish brown; a very prominent chocolate-brown transverse area across the middle of the clavus, reminding one of a "saddle," which at once distinguishes this species from all others described.

The male is smaller in size, with the frons entirely pale yellowish; the elytra a more decided chalky white; and the "saddle" area somewhat darker.

Length of body, female 3.5 mm., male 2.75 mm.; length to tip of elytra, female 5.75 mm., male 4.75; width across the elytra, female 2.25 mm., male 2 mm.

Described from one female and three males collected at lights, Port-au-Prince, Haiti, April 18–June 2, 1930, by the writer.

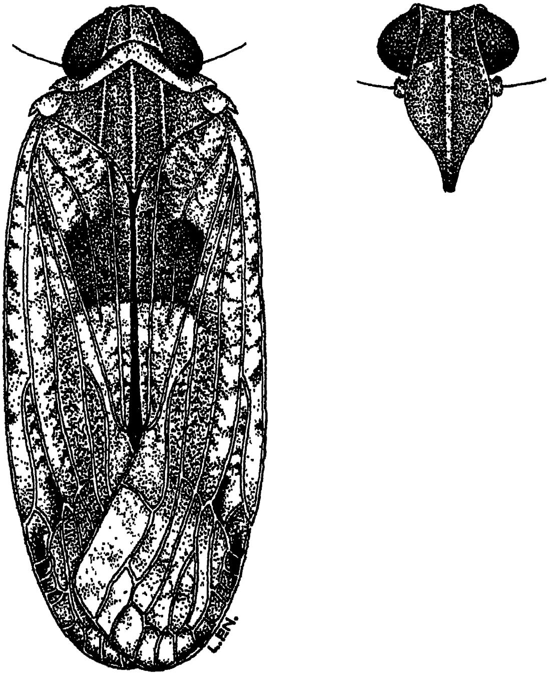

Fig. 10. Dorsal view of adult female *Catonia haitiensis*, new species, and frons.

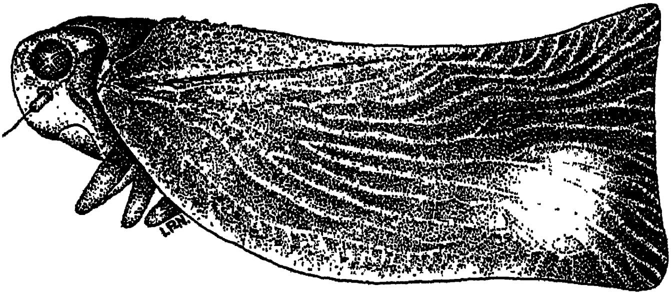

Fig. 11. Lateral view of adult female *Ormenis coffeacola*, new species.

Ormenis coffeacola, new species

Figure 11

Easily distinguished by its truncated elytra and distinct translucent pale spot toward apex.

General color pale grayish-brown, darkened along apical border of elytra; a very distinctive irregular pale white area on lower half of elytra toward the apex; head and thorax testaceous orange; eyes reddish brown. Frons only slightly longer than wide, with a rather indistinct median carina present, testaceous in color without markings; antennæ short, pale orange. Scutellum slightly arched, with median and lateral carinæ faintly indicated. Elytra nearly three times as long as wide, very much broadened behind to truncated apex, the apical angles distinctly produced although slightly rounded; longitudinal veins numerous, elevated but inconspicuous as they are concolorous with the elytra; numerous granulations or tubercles on clavus and a few scattered near base of corium and along base of costa. Legs testaceous.

Length of body, 3.5 mm.; length to tip of elytra, 5 mm.

Described from eight adults collected on coffee stems at Fond-des-Nègres, Haiti, February 14, 1930, by the writer (Acc. 30–62); six specimens collected at Aux Cayes, Haiti, March 19–20, 1922 (Amer. Mus. of Nat. Hist. No. F4644).

Coffee is the only host plant thus far known, for this species, and while abundant at times it does not appear to be of much economic importance.

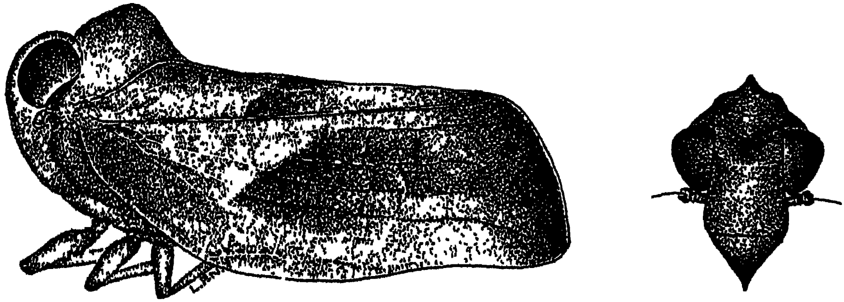

Fig. 12. Lateral view of adult female *Thionia gibbicollis*, new species, and frons.

Thionia gibbicollis, new species

Figure 12

The greatly elevated thorax will readily distinguish this unusual species.

General color yellowish brown with a blackish clouded area across middle of clavus and on elytra. Vertex transverse, twice as wide as long, distinctly emarginate on posterior margin. Frons nearly twice as long as wide, widened slightly toward apex, being broader at apex than between the eyes, without a distinct median carina; dark brown in color. Pronotum very short. Mesonotum and scutellum together forming a decidedly elevated gibbous hump, a median carina indicated, forming a discal peak. Elytra two and a half tims as long as wide, sloping downwards at apex; the longitudinal veins distinct, the cross-veins simple. Legs with the femora a rusty brown, the tibiæ and tarsi testaceous yellow.

Length to tip of elytra, 4.75–5.25 mm.

Described from two females collected by sweeping and beating shrubbery at Hinche, Haiti, August 30, 1930, H. L. Dozier; a paratype female collected by W. A. Hoffman, labelled "Haiti," in the U. S. National Museum.

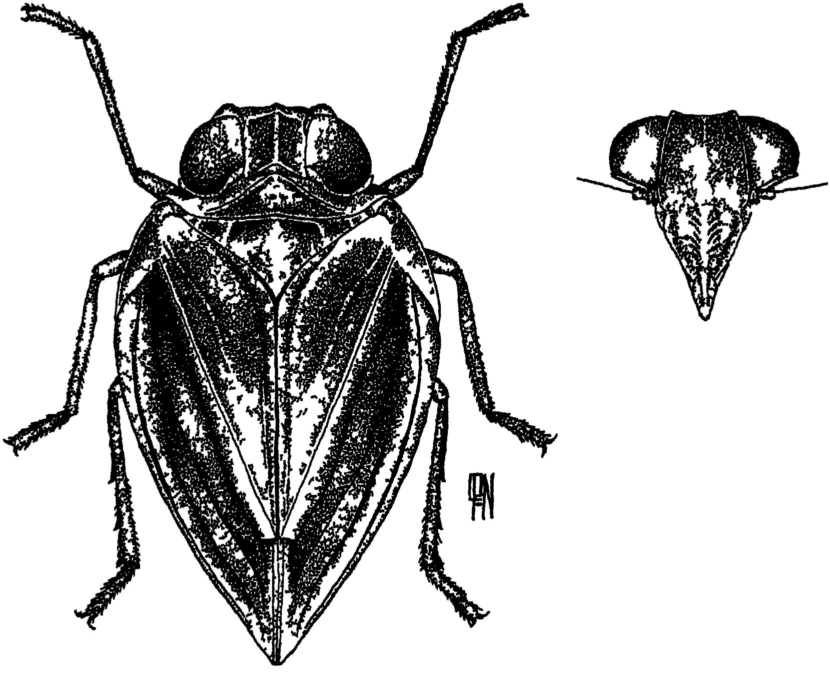

Fig. 13. Dorsal view of adult female *Thionia borinquensis*, new species, and frons.

Thionia borinquensis, new species

Figure 13

A very broad, compact species.

General color light yellowish-brown, the elytra with venation and certain clouding dark brown. Vertex slightly longer than wide, the margins and median carina distinctly elevated; anterior margin produced, slightly angulate at middle; posterior margin decidedly incised or emarginate. Frons nearly twice as long as wide, widened below, being distinctly wider at apex than between the eyes, a median carina present, very pronounced for a third of its length from base, becoming less distinct toward apex; surface of frons somewhat rugulose or uneven, yellowish brown without definite markings; the clypeus with partial, short, lateral, oblique dark brown stripes that appear characteristic of the species, although in some examples more mixed and indistinct. Pronotum short, strongly produced forward, with two small depressions on disk. Scutellum with a weak oblique lateral carina on each side, lacking a distinct median carina. Elytra almost twice as long as broad, presenting a very much broader appearance at base when viewed dorsally; the elytra slope obliquely downward at apex; venation very simple, the longitudinal veins very distinctly elevated, distinct cross-veins lacking; yellowish brown in color, the venation dark brown, a more or less distinct longitudinal pitch-brown clouding present, especially dark on corium. Wings light smoky brown, the venation distinctly darker.

Length of body, 5.5 mm.; length to tip of elytra, 6.75 mm.; greatest width, 3 mm.

Described from a series of six specimens collected at Aibonito, Porto Rico, July 14–17, 1914, in the collection of The American Museum of Natural History (Nos. 3708 and 3710).

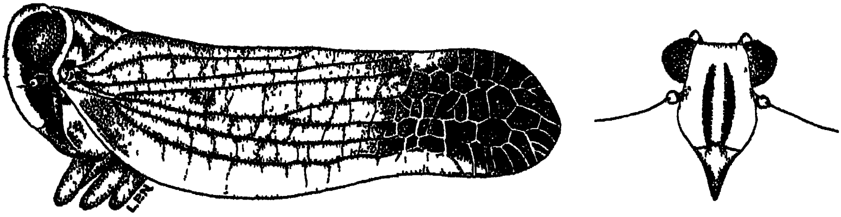

Fig. 14. Lateral view of female *Colpoptera clerodendri*, new species, and frons.

Colpoptera clerodendri, new species

Figure 14

Distinguished by its distinct yellow coloration and characteristic markings on frons.

The head and pronotum are a pretty yellow in life, fading considerably in dried specimens, the remainder testaceous; anterior and lateral margins of vertex fuscous; frons yellow with two very distinct, longitudinal, fuscous vittæ; mesonotum testaceous brown with a median and two lateral lighter colored stripes indicated. Elytra testaceous, venation fuscous, costal margin clear transparent, the apical portion infuscated

Vertex only half as long as wide, only slightly produced beyond the eyes; the disk of the vertex and pronotum distinctly depressed; mesonotum comparatively long, with no indication of a median carina and the lateral oblique carinæ very short and weak. Elytra about three times as long as greatest width, terminating in a distinct slope to the slightly rounded apex.

Length to tip of elytra, 6.75 mm.

Described from a series of nine specimens collected at Fond-des-Nègres, Haiti, by the writer, February 14, 1930, on "Hortensia," *Clerodendron fragrans* variety *pleniflora*, a large-leaved weed growing in thick stands in coffee glades (Acc. 30–61); a series of fifteen collected from same host at same locality, June 12, 1930 (Acc. 30–189); very abundant breeding on same plant on side of Tapion hill, June 13, 1930; a series taken sweeping near Kenskoff, June 19, 1930 (Acc. 30–207); a series of seventeen adults swept from *C. fragrans* at Kenskoff, June 6, 1931 (Acc. 31–104).

Colpoptera insularis, new species

The largest and longest true *Colpoptera* described.

General color and appearance a very dark fuscous, the vertex, frons, and legs paler; eyes reddish brown; vertex fuscous, except for a definite pale central area on the disk and at the hind angles; frons pale with a definite recognizable pattern of light brown markings, consisting of a series of fuscous fleckings around the margins, and a pair of irregular brown areas or spots on each side of the median carina on the disk; pronotum and mesonotum fuscous. Elytra entirely fuscous-black, except for a pale marginal fleck at tip of clavus and narrow translucent area running along the costal margin, distinctly enlarging inward just beyond the middle; venation concolorous.

Vertex transverse, about half as long as wide, lateral margins slightly elevated, the disk depressed; frons fairly wide at base, enlarging to well below the eyes and then roundingly narrowed to the clypeus; tricarinate, and, in addition, near the base, can be seen, on each side, the beginning of a very short, weak carina; pronotum produced anteriorly, the disk deeply depressed; mesonotum nearly four times as long as the pronotum, tricarinate. Elytra comparatively very long and narrow, narrowed only very slightly just before the apex which is well-rounded with a slight downward slope.

Length to tip of elytra, 7.25 mm.

Described from three specimens swept by the writer from coffee and a shrub in coffee glade at Fond-des-Nègres, Haiti, June 12, 1930 (Acc. 30–192).

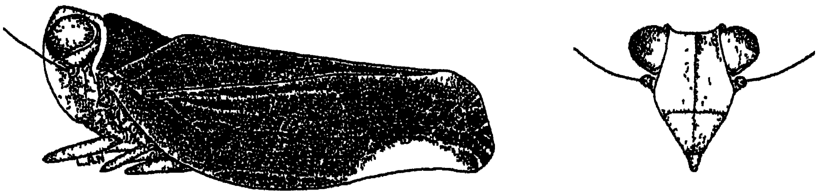

Fig. 15. Lateral view of *Colpoptera nana*, new species, and frons.

Colpoptera nana, new species

Figure 15

At once recognized by its very short, compact appearance; decidedly smaller than all known members of the genus.

General color varies usually from testaceous brown to a dark brown. The only conspicuous or definite marking is a small distinct, clear or translucent, area on hind margin of the elytra just before the apex; eyes pale; frons, vertex, pronotum, and legs are fuscous mottled with lighter testaceous; elytra dark brown except for the aforementioned clear spot, certain cross-veins near the apex, on terminal third of clavus, and the apical veins just at their tips which become pale.

Vertex transverse, less than half as long at the middle as its greatest width; pronotum longer than the vertex, produced anteriorly, fitting into the obtusely emarginate hind border of the vertex. Mesonotum slightly elevated, nearly three times as long as the pronotum, tricarinate. Elytra about two and a half times as long as its greatest width, decidedly widest across the middle, the hind margin narrowing to the apex: venation prominently elevated.

Length to tip of elytra, 3.75–4 mm.

Described from an adult collected by H. E. Box at Bona, Dominican Republic, July 5, 1925; five adults taken sweeping low shrubbery and weeds at Kenskoff, Haiti, August 24, 1930, and June 19, 1930 (Acc. 30–206); five adults from Kenskoff June 6, 1931 (Acc. 31–115); and two adults collected sweeping at Hinche, Haiti, August 30, 1930, by the writer.

It is thought that the weed, "Langue chatte," *Eupatorium odoratum*, may be the host-plant of this species.

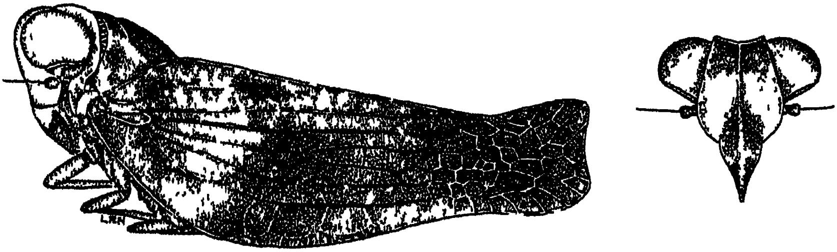

Fig. 16. Lateral view of adult female *Colpoptera maculata*, new species, and frons.

Colpoptera maculata, new species

Figure 16

Distinguished from the other described species of the genus by its maculated elytra and distinct male genitalia.

General color pale testaceous-brown with very characteristic fuscous clouding and maculations; eyes pale; vertex pale with fuscous stripe along lateral margins; frons pale, the upper third unevenly clouded with fuscous; pronotum mottled, the mesonotum distinctly fuscous on disk between the lateral carinæ, elytra pale testaceous with a fuscous area on clavus and corium near base, a small spot near middle of clavus, and a more or less distinct fuscous clouding covering most of apical two-thirds of the elytra; venation concolorous with the areas except near apex where they appear very pale contrasted with the dark coloration.

Vertex transverse, about one-third as long as wide; frons narrow at base, enlarging gradually to below eyes and then rounding to the clypeus, tricarinate; pronotum produced obutsely forward, slightly longer than the vertex, with very characteristic pitlike depressions along the sides; mesonotum over three times as long as the pronotum, tricarinate; elytra nearly three times as long as greatest width, narrowing gradually to just before the apex where it enlarges, terminating distinctly wedge-shaped.

Male genitalia: periandrium forming a tube. Genital styles large, produced into slender process at apex, the upper margin with distinct hairs or setæ.

Length to tip of elytra, 6 mm.

Described from a series of five adults collected by the writer at Guanica, Porto Rico, February 12, 1925; five adults collected by H. E. Box at Aguirre, February 1925; one adult from Juana Diaz, February 11, 1925, by the writer; three adults from Ponce, July 20–22, 1914 (Amer. Mus. Nat. Hist. No. 3716); one specimen from Maricao, July 27, 1914 (No. 3724); one specimen from Tallabao near Ponce, July 23, 1914 (No. 3720); two specimens taken on Mona Island, February 21–26, 1914 (Nos. 3508C and 3516).

This appears to be the most abundant species of *Colpoptera* in Porto Rico.

NEOCOLPOPTERA, new genus

Very close to *Colpoptera* and differentiated from that genus principally by its slightly more produced head and its distinctly longer form. The general coloration of the known species is very pale in contrast to the described species of *Colpoptera.*

Vertex distinctly produced beyond the eyes, the margins carinated, the disk depressed; the posterior margin distinctly emarginate, into which fits the angulately produced pronotum; viewed from above, the sides of the genæ flare outward; mesonotum with or without median carina, the lateral carinæ originating at a point just below the anterior margin at the middle, run downward and outward in an oblique manner and then turn down. Frons starting narrow, gradually rounding and enlarging to a point on a line with the lower margin of eyes or well below, then narrowing again to the clypeus. Elytra comparatively long and slender.

GENOTYPE.—*Neocolpoptera portoricensis*, new species.

Neocolpoptera portoricensis, new species

Figure 17

A large, robust species, easily recognized by its markings. In life there is a sulphur-yellow spot or area on the upper middle of the elytra, all signs of which fade after death.

General color a pale testaceous, the carinæ of the vertex, thorax, and frons, fuscous; frons pale except the fuscous carinæ; eyes light brown; venation of elytra distinctly fuscous; a short cross-band near base of clavus, a clouded area covering tip of clavus, and an extended clouding on apical portion of elytra, fuscous; legs with lineate fuscous markings.

Vertex extending well beyond the eyes, very short, the hind margin deeply emarginate, into which fits closely the obtusely angled, produced pronotum, from dorsal view the base of the frons and the flared upper sides of the genæ can be plainly seen The disks of both the vertex and the pronotum are depressed, accentuated by the fuscous carinated lateral margins Frons twice as long as its greatest width, starts narrow, gradually enlarges to well below the eyes and then roundly narrows to the clypeus, tricarinate Mesonotum slightly roundingly elevated, with very prominent carina, the lateral carina, joined together at an acute right angle near the anterior margin, run obliquely in an almost straight line and then are cut short by a downward dash, the median carina anteriorly joins or bisects the right angle made by the lateral carina and extends almost the entire length of the mesonotum, on the sides of the mesonotum are two short fuscous elevations

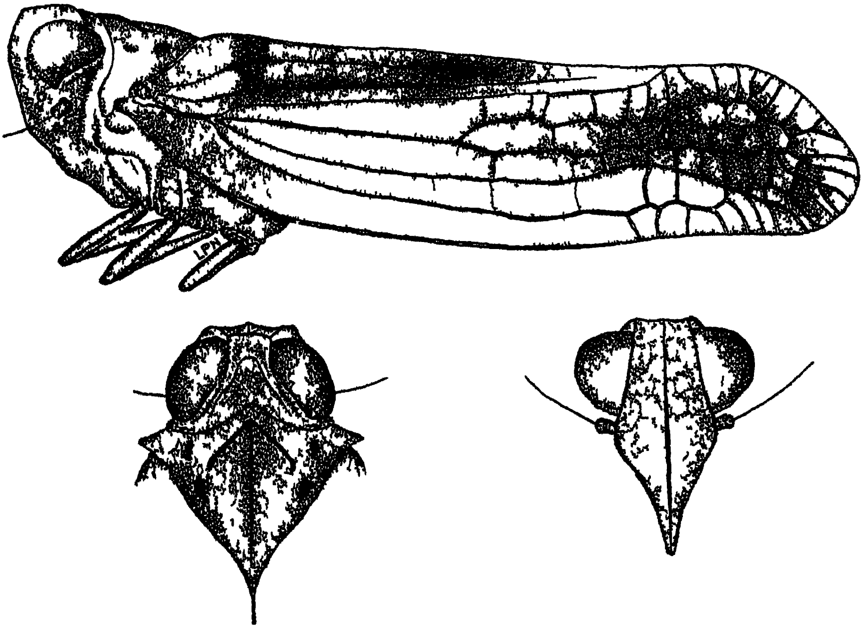

Fig 17 Adult female *Neocolpoptera portoricensis*, new species, dorsal view of head and thorax and frons.

Length to tip of elytra, 8 25 mm

Described from five specimens collected at Aibonito, Porto Rico, July 14-17, 1914 (Amer Mus Nat. Hist Nos 3707-9 and 3523B)

Neocolpoptera monticolens, new species

Figure 18

Apparently congeneric with *N portoricensis* but a much more slender and delicate species It appears to be confined to the high mountains of Porto Rico

General color pale testaceous yellowish including the eyes, the upper two-thirds of the elytra for its entire length dark fuscous, leaving the costal region a clear transparent This striking coloration immediately identifies the species The marginal carinæ of vertex, the pronotum, and the sides of the mesonotum a distinct fuscous Frons pale, without markings except the fuscous basal margin joining the vertex

Vertex distinctly produced beyond the eyes, the margins elevated, the disk depressed, less than one-third as long as the mesonotum, pronotum very short, produced forward at the middle at an acute angle, fitting into the emarginate hind border of vertex Mesonotum about as long as wide, with only the faintest indication of a possible median carina, the lateral carinæ are joined forward at the middle near anterior margin, continue downward obliquely, then straighten out, terminating about halfway down, the somewhat flattened disk is outlined by the lateral carinæ Frons nearly twice as long as wide, starting narrow and then enlarging gradually to its widest part on a line with the lower margin of the eyes, then again narrowing to the clypeus, the margins elevated and a median longitudinal carina is present

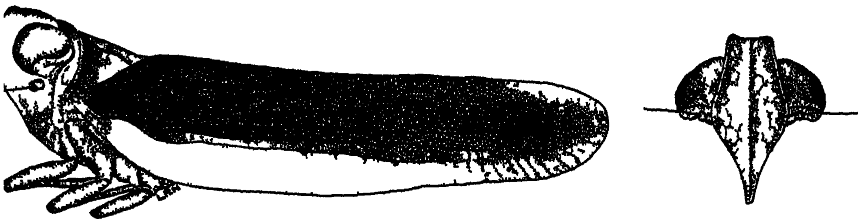

Fig 18 Lateral view of adult female *Neocolpoptera monticolens*, new species, and frons

Length to tip of elytra, 7 5 mm

Described from a series of seven adults collected at Aibonito, Porto Rico, July 14–17, 1914 (Amer Mus of Nat Hist No 3709), one specimen from Cayey, Porto Rico, May 30, 1914 (Amer Mus of Nat Hist F3931), and several adults taken by the writer beating shrubbery in tropical rain forest on El Yunque, Porto Rico, February, 1925

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GENERA AND NEW SPECIES OF GROUND SLOTHS FROM THE PLEISTOCENE OF CUBA

By W. D. Matthew[1]

With Prefatory Note by Walter Granger

PREFATORY NOTE

For many years the Department of Vertebrate Palæontology has been in possession of a large collection of vertebrate fossils from the Pleistocene of Cuba. The greater part of this material is from the hot springs deposit of Ciego Montero and was collected by Mr. Barnum Brown in the years 1911 and 1918, with the cooperation and assistance of Professor Carlos de la Torre of the University of Havana. In addition to the Ciego Montero material there is also a collection from the Casimba of the Sierra de Jatibonico belonging to Professor de la Torre and kindly lent by him for comparison and description. The Sierra Jatibonico fauna is probably contemporary with that from Ciego Montero but represents a somewhat different facies.

It has been intended to bring out a Memoir upon this material under the joint authorship of Professor de la Torre, Doctor Matthew, Mr. Brown and others, and some portions of it, including Doctor Matthew's treatment of the Mammalia, have been ready for some time, but it will be two years or more before the Memoir can be published. In the meantime it has seemed advisable to publish certain generic and specific descriptions from Doctor Matthew's manuscript in order to give standing to some generic names which he created and which have been published, but without reference to species. These generic names proposed by Doctor Matthew for three forms of small ground sloths are *Mesocnus*, *Miocnus* and *Microcnus*.

The names first appeared in 1915[2] in an abstract of the *Proceedings of the Palæontological Society* (Carlos de la Torre and W. D. Matthew). No diagnoses were given beyond a reference to size, and no species were mentioned. In 1918[3] in a paper on the "Affinities and Origin of the Antillean Mammals" before the Palæontological Society, the three genera were again mentioned and some distinguishing characteristics given, but still no mention of species. In 1919[1] in a paper on "Recent Discoveries of Fossil Vertebrates in the West Indies and their Bearing on the Origin of the Antillean Fauna," the three genera were mentioned for the third time, without reference to species, but with adequate diagnoses.

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[1] Doctor Matthew died on September 24, 1930, at Berkeley, California. He left at the American Museum, shortly before his death, several completed or partially completed manuscripts, some of which will be brought out in Museum publications within the next few years. The extracts which form this paper are from one of these manuscripts.

[2] Bull. Geol. Soc. Amer., XXVI, No. 1, p. 152.

[3] Bull. Geol. Soc. Amer., XXIX, No. 4, p. 660.

The descriptions which follow are extracted from Doctor Matthew's manuscript for Chapter III of the Memoir, "Description of the Fossil Mammals and Discussion of their Affinities," and the type of each genus is here designated for the first time.

WALTER GRANGER.

AMERICAN MUSEUM, DECEMBER, 1931.

Mesocnus[2]

1915, Bull. Geol. Soc. Amer., XXVI, No. 1, p. 152 [nomen nudum]; 1918, Bull. Geol. Soc. Amer., XXIX, No. 4, p. 660; 1919, Proc. Amer. Phil. Soc., LVIII, p. 168.

Type *M. browni*

GENERIC CHARACTERS.—Anterior teeth of moderate size, the upper pair oval and obliquely set, as in *Megalonyx*, the lower pair almost semicircular in cross-section, the inner side deeply grooved. Symphysis with a rather long median tongue slightly decurved. Cheek teeth subquadrate, obliquely set, the last lower teeth largest.

Skull slender, more elongate anteriorly, with a marked constriction in front of cheek teeth.

Humerus with no infraorbital foramen.

The two species are distinguished by size and robustness and by minor characters in the teeth.

Mesocnus browni, skull, jaw.

Mesocnus torrei, jaw.

Mesocnus browni, sp. nov.

TYPE.—Amer. Mus. No. 16877, anterior half of skull from Ciego Montero, Amer. Mus. Expedition, 1911.

PARATYPE.—Amer. Mus. No. 16878, lower jaw from the same locality.

The skull is widely different from that of *Megalocnus*, intermediate in some features between that genus and the Santa Cruz Megalonychidæ, in others peculiar.

The skull is narrow and rather deep in the orbital region; in front of the orbits it is sharply contracted and then flares out a little at the muzzle. Although the cranial portion is not preserved, the relations of the jaw condyles to the tooth row indicate that the basicranial and basifacial axes were nearly in the same plane, the front of the skull not depressed relative to the cranium as it is in *Megalocnus* and *Miocnus*.

The palate is narrow, its width between the tooth rows barely exceeding the width of either row. Immediately in front it is sharply constricted and expands again anteriorly to the oval canine alveoli, which are about as far apart as the molars. In front of these it extends forward, the maxillaries ending about one-fourth inch in front of the canines, and deeply notched at the middle line, the premaxillaries extending further forward as flat plates, only a small part of which is preserved. These premaxillæ, so far as preserved, resemble those of *Eucholœops* and *Megalonychotherium.* The canine socket is very like that of *Megalonyx;* the tooth, however, as will be seen, is widely different. The sockets of the cheek teeth are of characteristic form, the first triangular with broad side internal, the second and third obliquely quadrate, wider than long; the fourth triangular like the first but with flat side outward.

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[1] Proc. Amer. Phil. Soc., LVIII, p. 168.

[2] [*Mesos*, middle; *oknos*, sluggard.]

LOWER JAW.—There is some suggestion of *Megatherium* in the elongate, decurved, spout-like symphyseal tongue and the sharp convexity of the inferior border beneath and behind the molars. Otherwise it is more like the Santa Cruz Megalonychidæ, although not near to any one of them. The canine alveoli are about 20 mm. apart and the same distance in front of the cheek teeth; they indicate a tooth strongly convex externally, deeply grooved internally, somewhat smaller than in *Miocnus antillensis.* The symphyseal tongue is spatulate, decurved, 28 mm. long and 17 wide, with a sharp median crest on the under side; the anterior mental foramina are remarkably large, and the anterior end of the symphysis is rugose and somewhat thickened. These apparently indicate an extended flexible lower lip, such as is generally attributed to *Megatherium.*

TEETH.—The three lower cheek teeth increase from first to third in size, all of them being more or less trapezoidal in cross-section, but set obliquely in the jaw. The first and second are wider than long and the external side wider than the internal; the third is more nearly quadrate. All of them curve backward in the jaw, so that the base of M^2 lies beneath M^3.

The lower canine is of rather peculiar form, rudely meniscoid in cross-section, with a concave posterointernal, a flat anterior face and the external face flat medially, curving anteriorly and posteriorly around to the other surfaces. The tooth is but slightly curved. [P^1–M^3=42 mm. (approx.); C–M^3=73 mm.][1]

Mesocnus torrei, sp. nov.

A smaller species, less robust, molar teeth relatively smaller, and M_3 with posterior and internal faces merged into a single convex face.

TYPE. Amer. Mus. No. 16879,[2] a lower jaw, the symphysis and left ramus with all the teeth, but the condyle angle and coronoid process incomplete. From the Casimba in the Sierra Jatibonico, La Torre collection.

A second lower jaw in the La Torre collection and a few separate teeth are referred to this species. It has not been recognized in the Ciego Montero material. [M_{1-3}=27 mm.; C M_3=54 mm.]

Miocnus[3]

1915, Bull. Geol. Soc. Amer., XXVI, No. 1, p. 152 [nomen nudum]; 1918, Bull. Geol. Soc. Amer., XXIX, No. 4, p. 660; 1919, Proc. Amer. Phil. Soc., LVIII, p. 168.

Type *M. antillensis*

GENERIC CHARACTERS.—Jaw short, massive, anterior teeth semicylindrical with no groove in posterointernal face. Cheek teeth subquadrate, not obliquely set. A short symphyseal tongue. Anterior teeth obliquely worn; wider apart than in *Mesocnus*, much wider than in *Megalocnus;* condyles high above tooth row as in *Megalocnus*, unlike *Mesocnus*.

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[1] The measurements, in brackets, at the end of each species description, have been added to give better comparisons As only one of the four types here described possesses a full set of cheek teeth, the measurements have been taken between the alveolar borders in each instance. W. G.

[2] Professor de la Torre has generously presented to the American Museum the various type specimens contained in his collection. W.G.

[3] [*Meion*, less; *oknos*, sluggard.]

Miocnus antillensis, sp. nov.

TYPE.—Amer. Mus. No. 16880, a lower jaw lacking condylar and angular region and with the alveoli only of the teeth. From the Casimba, Sierra Jatibonico, de la Torre collection.

PARATYPE.—Amer. Mus. No. 16881, a left ramus of the jaw, broken off at alveolus of M_1 but with condylar and angular region nearly complete and M_{2-3} preserved. A few teeth are doubtfully referable.

DISTINCTIVE CHARACTERS.—Size medium, $M_{1-3} = 33$ mm.; $C-M_3 = 53$ mm. The canines are of semilunate cross-section, the posterointernal face being flat instead of strongly concave as in the other three genera. The second and third molars are more rectangular in cross-section than in *Mesocnus;* they are of nearly equal size, M_2 being larger, M_3 smaller than in *Mesocnus browni*. The first molar is not preserved but was evidently larger and more quadrate than in *M. browni*, as is also the canine. The symphyseal tongue is of quite different type from that of *Mesocnus*, shorter, pointed instead of spatulate, not decurved, and much less rugose at the tip. The anterior mental foramen is small in contrast to its enlargement in *Mesocnus*. The inferior face of the symphyseal tongue has a rounded median ridge, different from the sharp crest of *Mesocnus*.

The condylar region is raised high above the dentigerous part of the jaw, like that of *Megalocnus* but to a less degree. The angle is at or below the level of the tooth row; the coronoid process is as high as the condyle or higher; the dental foramen slightly above the line of the alveolar border. The condyle has the usual transverse expansion, flat upper surface rolled downward at the inner end. [$M_{1-3} = 33$ mm., $C-M_3 = 55$ mm.]

Microcnus[1]

1915, Bull. Geol. Soc. Amer., XXVI, No. 1, p. 152 [nomen nudum]; 1918, Bull. Geol. Soc. Amer., XXIX, No. 4, p. 660; 1919, Proc. Amer. Phil. Soc., LVIII, p. 168.

Type *M. gliriformis*

GENERIC CHARACTERS.—Anterior tooth grooved posterointernally. Molars subquadrate, not oblique, grooved on inner and outer sides. Condyle little elevated above tooth row. Symphysis short, tongue vestigial.

Microcnus gliriformis

TYPE.—Amer. Mus. No. 16882, a right ramus mandibuli with two last molars and alveoli of M_1 and C_1. From the Casimba in the Sierra Jatibonico, La Torre collection.

DISTINCTIVE CHARACTERS.—Size very small; molars only 22.5; entire tooth row approximately 29 mm. The last molar somewhat longer than wide, 6×7 mm., subquadrate, a distinct but narrow and shallow groove on each side. Second molar

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[1] *Mikros*, small; *oknos*, sluggard, i.e., sloth.

6×5 mm., also grooved on both sides, but the outer groove near posteroexternal corner and external side in front of it, strongly convex. The first molar is not preserved, but the alveolus indicates a rounded subtrigonal cross-section and size about equal to M_3. The post-canine diastema is short, only 5 mm. The anterior border of the canine alveolus is destroyed, but enough remains to indicate a tooth much like that of *Megalocnus* but probably not so broad.

The symphysis is quite short and wide, shaped as in *Megalocnus*, and the symphyseal tongue appears to be absent.

The lower border of the jaw is only moderately convex beneath the molars. The posterior portion of the jaw is singularly like certain Rodents, especially *Paramys*. The condyle is transversely expanded, set upon a long neck, the glenoid facet facing superiorly, nearly flat anteroposteriorly, rolling down on the inner side to a nearly vertical plane. The angle is broad, flat, thin, slightly incurved. The coronoid process is triangular, thin, somewhat higher than the condyle and separated from it by a broad, deep, rounded notch; the anterior border of the process springs from a point just behind M_2. The posterior mental foramen is beneath M_2 and near the alveolar border. The dental foramen is beneath the broad notch just mentioned and somewhat below the level of the tooth row. [$M_{1\text{-}3} = 24$ mm., C-$M_3 = 33$ mm. (approx.)].

No additional specimens can be positively referred to this genus and species, but a few loose teeth display the characters indicated above and are of appropriate size; certain skull fragments and skeletal bones distinct in type from the larger genera may be referred to *Microcnus* by exclusion, although I have little faith in such identifications.

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ON THE SYSTEMATIC POSITION OF THE GENUS *DISCOSORUS* HALL AND RELATED GENERA

By Curt Teichert[1]

Bigsby for the first time described specimens of a genus, still unknown to him, which was later called *Discosorus*. When in 1828 he published his paper on the Geology and Geography of Lake Huron,[2] he figured a few problematic fossils which he called "columns composed of circular discs." Bigsby, in his usual extremely careful manner, did not name these fossils, although they are not more difficult to identify than most of the specimens described by him in later publications.

In 1852, Hall[3] described a specimen of the same kind from the Silurian of the State of New York and named it *Discosorus*, with *Discosorus conoideus* as the only species. Unfortunately, one year earlier Hall had described another species from Michigan under the same specific name.[4] In view of the fact that Hall apparently in his manuscripts described the Michigan species first and the publication of his paper was delayed involuntarily, Foerste in 1924[5] designated the New York specimen as the true *Discosorus conoideus* and therefore as the type of the genus, whereas he gave the name *Discosorus halli* to the Michigan specimen. This opinion of Foerste does not seem to be in accordance with the International Rules of Nomenclature. The specific name *conoideus* has to be maintained for the species first described under this name, and the New York specimen will have to be renamed.

Hall, in describing the genus, did not place it in the systematic order, and refused to give it any distinct place. He says (p. 99): "I propose this name for a peculiar fossil body whose relations are at present unknown to me."

Thus the question as to where to place the genus *Discosorus* was undecided when Barrande in 1866 took up the problem. He discusses the characters of *Discosorus* in several places in his monograph on the cephalopods of Bohemia, and nearly every time he touches upon the question he has another view of it.

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[1] Geologisch-paläontol. Institut, Technische Hochschule, Berlin, Germany.

[2] 1828, 'Trans. Geol. Soc. London,' I.

[3] 1852, 'Pal. of New York,' II.

[4] 1851, Foster and Whitney's Rept., p. 222.

[5] 1924, 'Silurian Cephalopods of Northern Michigan,' Contributions from the Mus. of Geol., Univ. of Mich., II, No. 8.

In 1866, Barrande[1] reproduced two of the figures given by Bigsby, but with the apical end down. He regards the "columns" as siphuncles of cephalopods for the first time, thus putting *Discosorus* into this group. He points out a possible relationship between *Discosorus* and forms like *Orthoceras docens,* the siphuncle of which decreases in diameter very rapidly towards the living-chamber. In the same way he explains the *Discosorus* specimens as siphuncles, the segments of which are very wide at the base of the phragmocone and extremely narrow at the top.

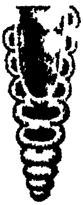

Fig. 1. *Endodiscosorus* sp. from Drummond Island.

(Reproduced from Barrande, 1877, Pl 474, figs 9–10 See also Foerste, 1924, Pl IX, fig 2)

In 1870 Barrande[2] had changed his mind and figured a specimen which he called *Orthoceras* (*Discosorus*) *conoideus,* from the shore of Lake Timiskaming in Canada, with the apical end down. He was later convinced that this siphuncle belonged to the group with segments increasing in diameter towards the living-chamber and beginning with very narrow segments at the base. However, very carefully he states that he believes he recognizes obstruction rings in the arrangement of the endosiphuncular deposits.

Again in 1871[3] he figured two specimens of *Discosorus,* the one published as Figs. 9 and 10 being the more interesting of the two. This is a rather small specimen, here reproduced as Fig. 1, with a clearly visible endocone. There is nothing like obstruction rings in the interior of the siphuncle. The endocone has smooth walls and increases in diameter continually towards the top of the specimen. Barrande, however, does not discuss the characteristics of this specimen in this place.

In 1874[4] he devoted a whole chapter to the *Discosorus* question. He recognized that several different types are to be found among the specimens placed in this genus, but he was then entirely uncertain about its systematic position. He even tended to doubt whether it belonged to the cephalopods at all. Thus he writes (p. 752): "En somme, malgré les apparences extérieures semblables ou très analogues, que présentent les divers fossiles que nous venons de passer en revue, il ne serait pas rational d'admettre en ce moment, qu'ils sont de même nature générique.

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[1] Système Silurien du Centre de la Bohême.' 1ière Pt , II, Céphalopodes. Pl. 232, Figs. 1–2.
[2] Ibid , Pl. 437, Figs. 19–20.
[3] Ibid., Pl. 474, Figs. 7–10.
[4] Ibid Texte, Part III, pp. 750–752.

On peut aussi douter, qu'ils appartiennent tous, ou même en partie, à la classe de Céphalopodes."

Whitfield in 1882[1] described a specimen of *Discosorus conoideus* with partly preserved septa which cleared up the affinities of the genus. Nevertheless *Discosorus* does not appear in the lists of cephalopods given by Hyatt in 1884[2]. Foord, however, in 1888[3] described two new species of *Discosorus*. Moreover, he for the first time connected it with the Actinoceratidæ. He also observed a number of very characteristic facts pertaining to the endosiphuncular structure of this genus. He pointed out that "a large funnel-shaped sheath, recalling the similar structures of *Piloceras*, forms a conical chamber, which occupies the upper or more expanded part of the siphuncle. This sheath, doubtless originally membranous, has a sinuous outline, due to the concavities of the siphuncular segments. . . . The whole of the apical portion of the siphuncle as well as the space around the sheath, is infiltrated with calcareous matter, the cavity of the sheath being filled with matrix. . . . An endosiphon is present, but it is not very well preserved in any of the specimens I have examined." The longitudinal section of a specimen of *Discosorus conoideus*, figured by Foord as Fig. 25B, page 194, refigured here as Fig. 2, gives a very good idea of the general characters of the siphuncular structure of this genus. A rather large endocone in the upper half of the section continues into a small and narrow endosiphuncular tube in the lower part. There is also calcareous matter in the space left between the endocone and the endosiphuncular tube and the outer wall of the siphuncle. Furthermore, there is that very characteristic bump at the bottom of the endocone which is so significant for all the species of the genus *Discosorus*. Foord, however, failed to point out clearly what the affinities of this genus are to the other members of the Actinoceratidæ, and how it is justifiable to place with this family a genus the endosiphuncular structure of which he himself compares with that of the endoceroid genus *Piloceras*.

Apparently following the opinion of Foord, Hyatt in 1900[4] enumerated *Discosorus* among the Actinoceratidæ without discussing it in any detail.

Not until 1924 do we again meet with the genus *Discosorus* in the literature, when Foerste described and figured numerous species, among them several new ones. At the same time he split up what was formerly called *Discosorus* into two genera, leaving with *Discosorus* the shorter and more rapidly tapering forms, and putting the longer and more slender forms into the new genus *Stokesoceras*. He refigured and redescribed a number of the older type specimens of Hall and Foord. For the first time we here find together good pictures and descriptions of the several kinds of structures which we may encounter in the siphuncles of *Discosorus* and allied genera. Foerste's figure of *Stokesoceras gracile* (Pl. VIII, fig. 3A and B) reveals a typical section of the long and slender *Stokesoceras* type with its rather long and slowly tapering endocone with the walls of the endocone but slightly annulated. Another type is represented by Fig. 2 on Pl. VII, where the walls of the endocone are decidedly annulated. This specimen, which is named *Stokesoceras engadinense*, shows very clearly the passing of the endocone into the endosiphuncular tube. The latter has a very peculiar intermittent growth which so far has not been observed in any other specimen. A third type, represented by a specimen named *Stokesoceras romingeri*, on Pl. IX, fig. 2, will be discussed later.

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[1] Geol. Surv. Wisconsin, IV, 3. 'Paleontology,' Pl. XX, Fig. 6.
[2] 1884, 'Genera of Fossil Cephalopods,' Boston Soc. Nat. Hist., XXII.
[3] 1888, 'Catalogue of the Fossil Cephalopoda of the British Museum,' I, p. 194.
[4] Zittel-Eastman, 'Textbook of Palæontology,' Cephalopods.

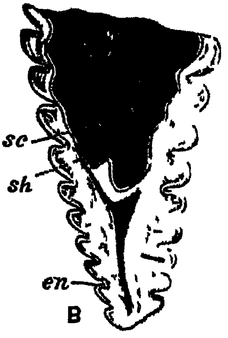

Fig 2

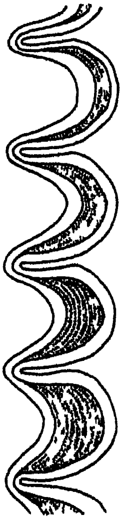

Fig. 3

Fig. 2. *Discosorus ehlersi* Foerste. From Drummond Island.
(Reproduced from A. H Foord, 1888, p 194)

Fig. 3. Diagrammatic sketch of the organic deposits within the siphuncle of *Discosorus*.
(From the specimen shown on figure 5.)

One of the specimens figured by Foerste (Pl. VII, fig. 5) as *Discosorus ehlersi* certainly does not belong to this genus or to this group. There is a calcareous lining along the walls of the segments of the siphuncle, but this does not increase in thickness towards the apical end, and no real endocone is visible.

In 1925, Foerste again[1] figured some of the specimens discussed in his previous paper. In addition, he established a few new ones and also described a new genus, *Megadiscosorus,* which he apparently regarded as closely related to *Discosorus.* Three species provisionally put into *Discosorus,* namely, *D.* (?) *vetustus, D.* (?) *geronticus,* and *D.* (?) *earltonensis,* certainly belong to *Armenoceras* rather than to *Discosorus.*

In 1927, Foerste and Savage[2] described a few new species of *Discosorus.*

The affinities and relationship of the genera *Discosorus* and *Stokesoceras,* and also *Megadiscosorus,* have not been discussed in any of these papers. However, valuable material has been brought together, which enables us, in connection with some other so far unpublished facts, to get a much better, though not yet complete, idea of the structure of this peculiar siphuncular body than would have been possible a few years ago.

When Foerste and Teichert in 1930[3] compiled the list of the known families and genera of the actinoceroids, they included *Discosorus* and *Stokesoceras* in this list and connected those two genera with the Armenoceratidæ as had been done by Troedsson in 1926.[4] However, the classification of *Discosorus* and *Stokesoceras* was attempted in this case with regard to the external shape of the siphuncles only, and without paying attention to the endosiphuncular structures and the remarkable and fundamental differences existing in this respect between those two genera on the one hand and the typical actinoceroids on the other.

It will be the purpose of the following pages to show that *Discosorus* and related genera belong neither to the Armenoceratidæ nor to the actinoceroids, but form a family themselves, though still of uncertain and doubtful affinities.

In the first place, I here shall take into consideration the characters of what is known to be the true *Discosorus* as defined by Foerste. A very characteristic longitudinal section of a true *Discosorus* has been figured by Foord (1888, p. 194) as *Discosorus conoideus.* A specimen with similar characters is in the collection of the National Museum in Ottawa and is

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[1] 1925, Foerste, in G. S. Hume, Paleozoic Outlier of Lake Timiskaming. Canada Geol. Surv., Mem. 145.

[2] 1927, Denison Univ. Bull., Journ. Sci. Lab., 22.

[3] 1930, Ibid., 25.

[4] 1926, Meddelelser om Grønland. 71.

shown here as Fig. 5. Though in this case the species cannot be identified with certainty, and the locality and horizon are unknown, the specimen undoubtedly belongs to the genus *Discosorus*. There is a very significant calcite lining on the inner side of the segmental walls which is thin in the upper segments and gradually increases in thickness from one segment to another in an apical direction. On the right side of the specimen, the inner side of this calcite layer is very concave in the upper four segments, but less concave in the fourth than in the first. It becomes still less concave in the next two segments, and the concavity has about disappeared along the inner side of the layer in the seventh and eighth segments. On the left side of the specimen, we see practically the same conditions, with the exception that the calcite layer is thinner on this side. It is absolutely sure that this calcite layer is of primary organic origin; otherwise it could not be explained why it increases so regularly and continually from one segment to the other. It is remarkable that the layer tends to fill out the outer parts of the segments only, whereas it remains of about equal thickness around the septal foramina along those places where septa or septal necks are supposed to have constricted the siphuncle.

The calcite filling of the exterior parts of the segments consists of three different layers. The outer layer continues along the walls of the segments, slightly increasing in thickness in the middle portion of each of the latter and decreasing when passing the septal foramina. Secondly, there is an inner layer which is in contact with the outer layer in the passage through the septal foramen, but free from contact for nearly the

Fig. 4. *Stokesoceras* cf. *engadinense* Foerste. Cockburn Island, Lake Huron. Niagaran Group.

No. 2743 in the National Museum in Ottawa. Magnified 1.6 diameters.

Fig. 5. *Discosorus* sp. Unknown locality and horizon in Canada.

No. 6367 in the National Museum in Ottawa.

Fig. 6. *Discosorus conoideus* Hall. Cockburn Island, Lake Huron. Niagaran Group.

No. 2743*c* in the National Museum in Ottawa. View into the endocone. Natural size.

Fig. 7. *Discosorus conoideus* Hall. Cockburn Island, Lake Huron. Niagaran Group.

No. 2743*b* in the National Museum in Ottawa. Magnified 1.6 diameters.

Fig. 8. *Endodiscosorus foerstei*, new genus and species. From the Niagaran of Lake Timiskaming.

In the private collection of the present writer. Holotype. Longitudinal section, magnified 1.6 diameters.

Fig. 9. Same as Fig. 8..

View from the opposite side, natural size.

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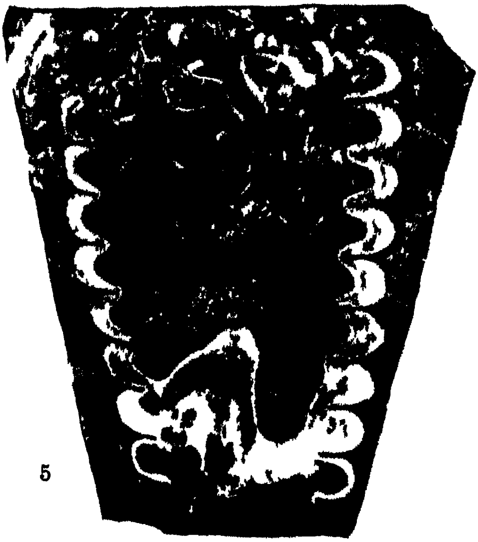

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Figs 4-9
(Captions on opposite page)

entire height of the segments. This layer has a constant thickness. Between the septal foramina, a third layer has been deposited between the inner and the outer layer. Apparently this third layer is the real organic deposit which is increasing continually. This layer in most of the segments has a lunette-shaped cross-section and doubtless was deposited by a membrane which may now be represented by the inner layer. Figure 3 may serve to illustrate the characters of these different deposits.

These three layers can be distinguished, roughly, in the figure given by Foord of what he called *Discosorus conoideus* (Fig. 2). It also can be seen that the middle layer grew in such a way that it lost its lunette-shaped cross-section very soon and that the layers of two adjacent segments came in contact. The lower part of the specimen is filled by a deposit which is a continuation of the middle layer, and only a narrow endosiphuncular tube is left open.

A remarkable feature of the endocone is an elevation or bump on its bottom. In true *Discosorus* the endocone seldom has a really conical shape. It always ends rather abruptly at a level where the endocone is still wide, and its bottom is made up by the same calcareous layer which builds the sides of the endocone. The bottom of the endocone never is evenly concave, but there is always a larger or smaller elevated area. This is elucidated not only by the specimen shown on figure 2, and figure 5, but is also very well illustrated by a smaller specimen shown in figure 6. It follows from the study of the latter specimen that the endosiphuncular tube originated in the center of this bump. The bump itself is not situated exactly in the central axis of the endocone, but is nearer the convex side of the specimen.

The deposits within the interior of the siphuncle of *Discosorus* never have the appearance of true "obstruction rings" as in the actinoceroids. There are no radial canals left to connect the endocone or the endosiphuncular tube with the walls of the segments or with the perispatium,[1] the free space between the obstruction deposits and the walls of the segments. In some specimens, something like a line of partition can be observed in the mid-height of the segments, dividing the deposits around one septal neck from the deposits around the septal neck below, as can be observed in a specimen of *Discosorus conoideus* (Fig. 7). However, no real canals have been observed in the level of this line of partition, and it may be assumed that this appearance is due to some process of

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[1] In his book "Der Bau der Actinoceraten" (in press), the present writer was able to reveal that the obstruction deposits in the interior of the siphuncle never come in contact with the walls of the segments. The free space between the obstruction rings and the walls of the segments has been called "perispatium."

recrystallization within the organic deposit after the deposition of the specimen in the sediment. It is remarkable that this line of partition never has been found in the upper segments, where the deposits are still small, but in the lower segments only. But even if the partition line were of primary origin in some specimens or species, its origin must be of a quite different type from that in the true actinoceroids.

Briefly, we may characterize the endosiphuncular structure of *Discosorus* as follows:

Deposits along the walls of the segments, increasing gradually towards the apical end, leaving free a rather wide endocone in the upper half of the siphuncle, but only a very small endosiphuncular tube in the lower part. Except the space left for the endosiphuncular tube, the lower part of the siphuncle is filled with organic deposits. No perispatium is left in the peripheric parts of the segments, and no connections between the endocone or the endosiphuncular tube and the peripheric parts of the segments exist.

Another related character is represented by the genus *Stokesoceras* Foerste. As described by Foerste,[1] "*Stokesoceras* is intended to include those species which resemble *Discosorus romingeri* Foerste in being longiconic and relatively straight." Foerste regarded the external features of the siphuncle only, but there is also a difference in the endosiphuncular structure between this genus and true *Discosorus*. As can be judged from a specimen figured by Foord (1888, p. 26B) as *Discosorus gracilis* and refigured as *Stokesoceras* by Foerste (1924, Pl. VIII, fig. 3A, B), the endocone of this genus is longer than in *Discosorus*. Moreover, the endocone is more or less really conical and does not end abruptly as in *Discosorus*, but decreases gradually in diameter until the top passes into the endosiphuncular tube. The wall of the endocone is almost smooth, though sometimes very slightly convex between the septal foramina and slightly concave when passing through the latter.

The same conditions may be studied in the specimen of *Stokesoceras* cf. *engadinense*: figure 4 of the present paper. The organic deposit along the walls of the segments increases in such a way that a rather regular endocone results, edging out gradually and passing into the endosiphuncular tube which in this case is rather long. It can be traced until near to the last segment. It can also be seen from this specimen that in *Stokesoceras* the siphuncle begins with a very small segment, which is much smaller than any of the first segments known in true actinoceroids. In the latter the siphuncle begins with a rather large seg-

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[1] Silur. Ceph. of Mich., *loc. cit.*, pp. 70–77.

ment, and never do the segments increase in diameter so regularly toward the top as they do in *Discosorus* and *Stokesoceras*.

As in *Discosorus*, in *Stokesoceras* we never observe a perispatium.

Besides those two genera, a third genus belongs to this group, which differs from the other genera in some important features·

Endodiscosorus, new genus

Under this name I shall describe a genus which is represented among others by the specimen figured by Barrande in 1870 on Pl. 171, figs. 9 and 10, of his work on cephalopods, and refigured by Foerste in 1921 on Pl. IX, fig. 2. All the specimens of this genus are very short and are characterized by an endocone of entirely regular shape with smooth walls, always continuing into a clearly developed endosiphuncular tube. Furthermore, the walls of the segments of the specimens of this genus are not evenly rounded at their periphery, as in *Discosorus* and *Stokesoceras*, but tend to turn in a nearly right angle from the horizontal to the vertical and again from the vertical to the horizontal direction. Whereas the segments of *Discosorus* and *Stokesoceras* are flat ellipsoids, the segments of **Endodiscosorus** are flat cylinders.

The name **Endodiscosorus** is proposed in order to point out some affinities in the internal structure of the siphuncle between this genus and the endoceroids. This does not mean that in my opinion *Endodiscosorus* really is related to the endoceroids.

The genotype is **Endodiscosorus foerstei.**

Endodiscosorus foerstei, new species

Figs. 8, 9

Length of the entire specimen, 30 mm. Dorsoventral diameter 21 mm. at the top and 17 mm. at the base of the specimen. Average height of the segments, 3.5 to 4 mm. The endocone is regularly conical and thins out gradually into an endosiphuncular tube. Both endocone and endosiphuncular tube are situated eccentrically. The segments run obliquely to the vertical axis of the siphuncle. In the space between the wall of the endocone and the walls of the segments, some dolomitic material is preserved, which seems to have been deposited as vertical lamellæ, thus reminding one of the endosiphuncular sheaths of *Endoceras*. However, it is not at all sure that the lamellæ are the primary form of these deposits and not a result of later recrystallization as can be observed occasionally in the siphuncles of actinoceroids. In any event, the shape of the endocone and of the endosiphuncular tube in this specimen of *Endodiscosorus foerstei* is exactly the same as in specimens of *Endoceras*.

The holotype is from some unknown locality near Lake Timiskaming of the Niagaran group, and is in the private collection of the present writer.

Discosorus, *Stokesoceras* and *Endodiscosorus* form a family which I propose to call **Discosoridæ.** The Discosoridæ are not related to the actinoceroids. The presence of a clearly developed endocone and an endosiphuncular tube would rather connect them with the endoceroids; but, since endoceroids usually are holochoanitic and have straight and unconstricted or but very little constricted siphuncles, it seems unlikely that the Discosoridæ are related to them. On the other hand, nothing about the structure of the septal neck is known in any of the genera of the Discosoridæ. We do not know anything even about the shape and size of the shell of these fossil animals. Without doubt the Discosoridæ belong to the cephalopods; otherwise the presence of an endosiphuncular tube could not be explained. It is, however, impossible to decide to what order of the cephalopods the family Discosoridæ may belong.

It may be added that the genus *Megadiscosorus* Foerste is a true actinoceroid and, therefore, is not discussed on the previous pages.

ACKNOWLEDGMENTS

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